

NASA TOTAL QUALITY MANAGEMENT

ACCOMPLISHMENTS REPORT

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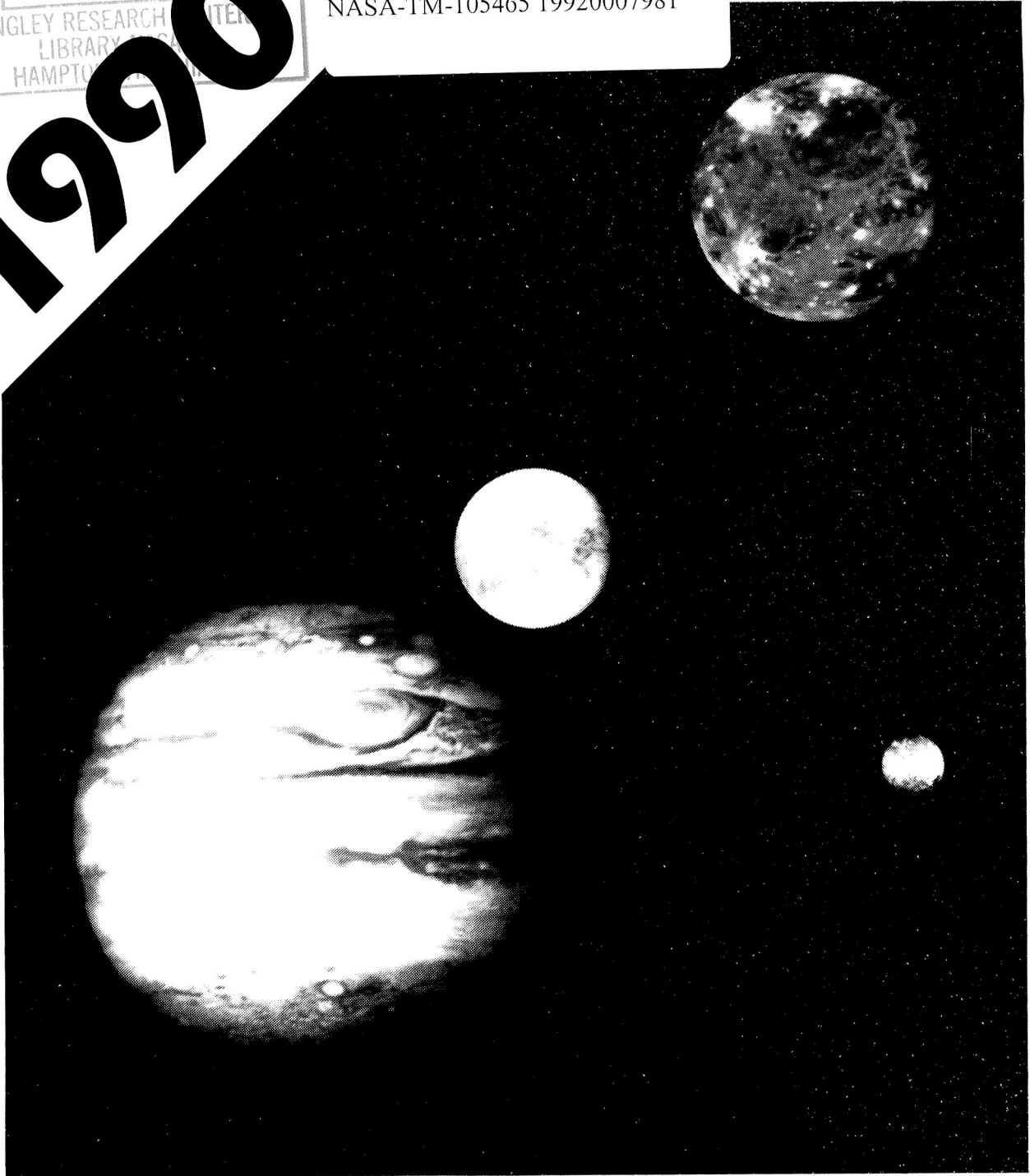
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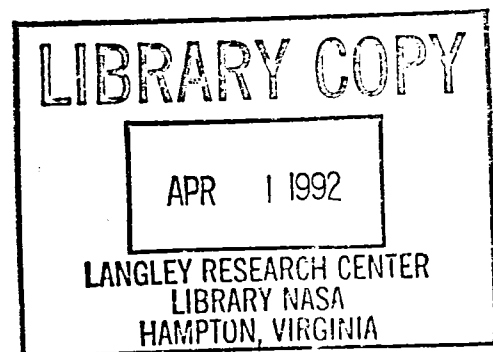
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NASA TOTAL QUALITY MANAGEMENT
1990 ACCOMPLISHMENTS REPORT

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NASA QUALITY AND PRODUCTIVITY IMPROVEMENT PROGRAMS DIVISION

SEPTEMBER 1991



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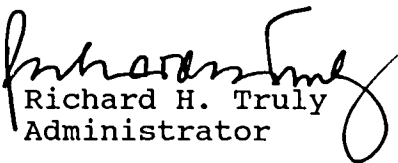


FOREWORD

For NASA and its Contractor community, 1990 was a year in which numerous accomplishments were made. Highlighted in this Eighth Annual Accomplishment Report are improvements that have made a significant difference in the operations of the Agency, as well as the space program. These improvements and strategies demonstrate that NASA is committed, as never before, to remaining a key player in the aerospace industry and to making quality, safety, reliability, and continuous improvement integral elements in all of our programs. With these cornerstones imbedded deeply within the NASA philosophy, it is our aim to have each NASA endeavor result in success from beginning to end.

Space exploration has enabled us to expand the Nation's communications systems and has provided invaluable research on the Earth's environment, science, and medicine. As we enter the last decade of the century, NASA has attempted to expand those achievements which have made this Nation a leader in the aerospace industry. The accomplishments detailed in this report show that we are still on the right track, providing efforts which indicate our total commitment to quality-enriched strategies.

Thank you for your contributions to these improvement efforts. Our accomplishments clearly demonstrate NASA's commitment to safety, reliability, and continuous improvement. I firmly believe our innovative approaches to problem solving enhance the Agency's operations, fulfill our space program goals, and act as a catalyst for continuous improvement throughout the aerospace industry.


Richard H. Truly
Administrator



PREFACE

NASA's efforts in Total Quality Management are based on continuous improvement and serve as a foundation for NASA's present and future endeavors. This Eighth Annual Accomplishments Report provides numerous examples of quality strategies that have proven effective and efficient in a time when cost reduction is critical. These accomplishments benefit our Agency and help to achieve our primary goal; keeping America in the forefront of the aerospace industry.

NASA has long understood that quality must undergird all of our efforts. As we near the next century, the skies will become an increasingly important frontier for research and development. Quality efforts and continuous improvement within the space program will directly affect everyone's future.

Each contribution made by the NASA work force is a significant achievement toward fulfillment of our goals. NASA's continuous improvement efforts can provide insight for others to succeed in their own endeavors. It is our hope that many of you will join us in the quality quest for excellence.



George A. Rodney
Associate Administrator for
Safety and Mission Quality

TOP MANAGEMENT LEADERSHIP AND SUPPORT

CATEGORY: Top Management Leadership and Support

1. PRODUCTIVITY AWARD FEE INITIATIVE

Ames Research Center (ARC)

Description of the Activity:

In 1989, the Director of Administration initiated action to establish a productivity improvement program as a part of the Center-wide logistics and administrative support services contract. Following negotiations with the contractor, the Quad S Company, it was agreed that a portion of the award fee would be set aside for accomplishments under this program. After two years of progressive effort and experimentation on the part of the contract Project Manager and contract associates, the Performance Evaluation Board, the contract COTR, and the functional managers, an extensive and innovative productivity improvement program has been implemented. The program is as multi-faceted as the contract itself. Two key components are the suggestion program and the development of "specific productivity initiatives". In addition, the program includes organizational development training; the establishment of teams to identify areas requiring improvement; and use of the Oregon Productivity Measurement system. The emphasis throughout all aspects of the program is on employee involvement and on the contractor providing visible rewards to their employees commensurate with the success of the program.

Benefits Achieved:

As a result of this program, contractor employees have implemented a wide range of productivity and quality improvements. These have included changes to warehouse operations; ADP-related improvements; recycling; procedural improvements; changes to forms; reduction in re-work; and numerous other improvements to both the quality and the timeliness of support services. Through this program, the contractor has been awarded sums of \$100 to \$10,000 for documented improvements that have been approved by the Performance Evaluation Board and the Fee Determination Official. The contractor has in turn used the award fee to fund the productivity program and to reward employees for their efforts and accomplishments. These rewards have included award ceremonies and picnics, tickets to major league baseball games for work groups and families, and individual/team cash awards as high as \$5,000.

Contact for More Information:

Leslie Kaufhardt
415-604-3407

CATEGORY: Top Management Leadership and Support

2. SECONDARY PAYLOADS PROJECT

Ames Research Center (ARC)

Description of the Activity:

The ARC Secondary Payloads Project was initiated to take advantage of Shuttle middeck flight opportunities and to develop and fly middeck-compatible Life Science flight experiments. Flight opportunities on the middeck are far more frequent than flights with the Spacelab. They afford life scientists an opportunity to fly self-sufficient experiments which can be precursors or follow-ons to more complex Spacelab experiments. The development of Secondary Payload Project experiments follows the same flow as the Spacelab experiments but, due to their lack of engineering complexity, development times have been compressed to an 18 month period. Significant cost reductions have also been achieved in the development and flight of the middeck experiments due principally to the rapid development and a streamlined management approach. Three middeck experiments have been flown by the ARC team over the past 14 months. This concept of small, rapidly developed experiments with minimal resource requirements, has gained international attention and is now being expanded to include a test bed for new hardware validation.

Benefits Achieved:

As a result of the Secondary Payloads Project, experimenters are provided the opportunity to participate in more shuttle flights. These middeck experiments have allowed Principal Investigators a mechanism to test hypotheses, and gather additional statistical data, maximizing the science return.

Contact for More Information:

Randall W. Berthold
415-604-3408

CATEGORY: Top Management Leadership and Support

3. CENTER STEERING COMMITTEE ESTABLISHED FOR TOTAL QUALITY MANAGEMENT (TQM)

Goddard Space Flight Center (GSFC)

Description of the Activity:

The Center Director established a TQM Steering Committee at the senior level and a TQM orientation was the first order of business. The Center Director encouraged the Center Executive Council to participate in a TQM technical orientation, conducted by Martin Marietta. The Center Director and Associate Director also attended this all-day course. The newly established Steering Committee and the full Executive Council also attended the Federal Quality Institute (FQI) TQM orientation. The Steering Committee made other recommendations for the Center to take steps for the implementation of a master plan for the involvement of GSFC and Wallops Flight Facilities in a comprehensive TQM program.

Benefits Achieved:

The TQM training taken by the Center Director and 25 senior executives provided them with the background and understanding of TQM concepts and practices needed to properly initiate TQM efforts upon their return to their directorates, institutions, programs, and projects.

Contact for More Information:

John Scully
301-286-8213

CATEGORY: Top Management Leadership and Support

4. TOTAL QUALITY MANAGEMENT (TQM) PROCESS IMPROVEMENT PLAN

Jet Propulsion Laboratory (JPL)

Description of the Activity:

A TQM Process Improvement Program Plan has been developed and approved by the JPL Steering Committee. The Program Plan is a high level document at this stage in the planning process and provides the foundation for which a detailed implementation plan will be developed.

Plans are being made to present the Plan, in presentation format, to JPL's Director and Deputy Director early-on in the calendar year (1991) for approval to proceed with detailed implementation.

Benefits Achieved:

Establishes the foundation for the development and direction of JPL's TQM Process Improvement Program.

Contact for More Information:

Willis Chapman
818-792-2550

CATEGORY: Top Management Leadership and Support

5. TOTAL QUALITY MANAGEMENT (TQM) STEERING COMMITTEE

Jet Propulsion Laboratory (JPL)

Description of the Activity:

A TQM Steering Committee was established in 1990. The Steering Committee is made up of senior level management, responsible for overseeing JPL's overall program requirements and implementation. The committee will ensure candidate projects and major work processes selected are in-line with the Laboratory's overall improvement strategy and NASA's TQM program.

Benefits Achieved:

Provides a JPL top management supported and coordinated effort.

Contact for More Information:

Willis Chapman
818-792-2550

CATEGORY: Top Management Leadership and Support

6. PLAN FOR CENTERWIDE TOTAL QUALITY MANAGEMENT (TQM) IMPLEMENTATION

Johnson Space Center (JSC)

Description of the Activity:

Early in 1990, the Center Director established a TQM Implementation Working Group representing JSC organizations. This group was chartered to provide recommendations on Centerwide implementation of TQM. After reviewing successful programs at various other large organizations, the Working Group recommended that the Center take immediate, aggressive action to:

- 1) Implement a total quality approach at JSC that would include senior staff involvement, and
- 2) Adopt a goal to improve the quality of the Center's processes, products, and services by a factor of 10 by 1995.

In response, the Center Director named a Total Quality Steering Committee headed by the Associate Director to implement the Working Group's recommendations. This committee was specifically tasked to assess JSC's current total quality posture and prepare a TQM implementation plan for the Center. As a first phase in implementing TQM, a March, 1991 retreat was planned for the Center's senior staff and their deputies. The retreat will be devoted to confirming the Center's strategic vision, identifying key issues, and applying a total quality approach to developing implementation plans to address those concerns.

Benefits Achieved:

Activities of the working group served to:

- 1) Educate managers at the Center on the principles and benefits of a TQM approach; and
- 2) Develop consensus concerning the need for a Centerwide TQM framework and set goals and objectives.

The Center Director's TQM Steering Committee is providing the Centerwide leadership necessary for developing and implementing this Centerwide TQM approach.

Contact for More Information:

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713-483-4723

CATEGORY: Top Management Leadership and Support

7. THE SPACE TRANSPORTATION SYSTEMS OPERATIONS (STSOC) CONTRACT TEAM EXCELLENCE PROCESS

Johnson Space Center (JSC)

Description of the Activity:

The STSOC team is made up of five contractors including Rockwell (RSOC), Unisys, Bendix, Omniplan, and SMA. Each company has implemented various initiatives to continuously improve operations and processes. Examples include productivity project teams, corrective action boards, and senior level committees which guide improvement activities, management development, and employee training.

Within this context the Rockwell STSOC Team has implemented a multi-company Team Excellence process. Although encompassing such standard dimensions as Work Plans and Employee Suggestions, the key element is an innovative grass roots Excellence Teams process. Over 125 Excellence Teams have been established across all five STSOC companies, and encompasses over 4,000 employees as team members. Team size varies, but the average is about 35 members, with team leadership provided by both management and non-management employees.

Teams are generally composed of individuals within departments who work together to provide a particular function on the contract. Team members define the team mission statement, select operational objectives consistent with STSOC goals, establish and track performance measurements, implement process improvements, and recognize accomplishments.

A highly visible characteristic of the Excellence Team process is the public display of information covering team activity and performance. The team determines how to exhibit charts and graphics appropriate to its goals and continuous improvement progress which are displayed on public bulletin boards in the team's work area. Reports on team progress, cost savings, and cost avoidance are made by each team's management to STSOC Program Management, creating effective cross functional management communication paths to and from every team within the organization.

The Team Excellence process, as a part of STSOC's total Operations Excellence process, now has a successful shelf-life approaching two years. It represents a new opportunity to implement the TQM philosophy in a complex multi-disciplined (and multi-company) organization.

Benefits Achieved:

The STSOC Team Excellence process provides a unique opportunity for implementation of TQM objectives, and has already resulted in cost savings and cost avoidances of over \$11.9 million during 1990. Top management supports Team Excellence through such visible means as weekly visits to teams to review progress. This process includes three executive level review teams, one led by the President, each of which visits at least three teams every week, completing a full cycle of all teams each calendar quarter. Strategic planning is enhanced since a wide variety of grass roots goals and objectives are integrated throughout the organization, action improvement plans are developed at all levels, and work plans are implemented with enhanced employee involvement. The process is by nature a wide reaching exercise in employee empowerment and teamwork, with extensive emphasis on team ownership of processes and participative management. This manifests itself into a unified organizational approach to pursuing, measuring, and tracking continuous improvement via team benchmarking and process analysis.

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Deed Vest
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CATEGORY: Top Management Leadership and Support

8. TOTAL QUALITY MANAGEMENT (TQM) IDENTIFIED AS AWARD FEE AREA OF EMPHASIS

Johnson Space Center (JSC)

Description of the Activity:

The Loral Aerospace Corporation (formerly Ford Aerospace) Safety, Reliability, and Quality Assurance (SR&QA) contract NAS 9-18290 is an award fee contract under which the amount of fee paid to the contractor is determined by a Performance Evaluation Committee (PEC) made up of JSC management associated with the contract effort. The contract specifies that 7.1 percent of the available award fee will be awarded on the basis of the JSC evaluation of "Management" performance. Similarly, 7.2 percent of the award fee is awarded under the "Program Support" evaluation area.

For the 6-month evaluation period starting August 1, 1990, Loral's effectiveness in implementing TQM was the only item identified by the PEC's areas of emphasis letter for these two categories. This resulted in a total potential weighing of 14.4 percent of award fee for TQM performance alone. As a point of reference, the award fee evaluation for the previous period involved a maximum potential award fee of over \$769,000; the maximum award fee for the current 6-month period will exceed that amount. Therefore, the 14.4 percent scoring based on TQM represents a major effort for JSC and Loral.

Benefits Achieved:

As a consequence of the emphasis placed on TQM performance by PEC for this contract, a major effort to implement TQM is currently underway at Loral. This is driving a concomitant effort by JSC counterpart managers of the SR&QA effort.

Contact for More Information:

Ronald J. Bartosh
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CATEGORY: Top Management Leadership and Support

9. EMPLOYEE OPINION SURVEY

Kennedy Space Center (KSC)

Description of the Activity:

The Quality Council at KSC contractor EG&G Florida, composed of senior managers, recently supported the initiative to conduct a total company employee opinion survey. The main goal of this survey was to get feedback from the employees at EG&G Florida about the company's strengths and weaknesses. Conducting a survey such as this is an excellent way to make sure that the company focuses its improvement goals in the areas that employees are most concerned about. A total of 2,991 surveys were mailed out to employees, of which 1,535 were returned. This represents a return rate of 51 percent, which is considered an excellent return rate.

Benefits Achieved:

The overall results of the survey were reviewed with the Quality Council as soon as they became available. The Quality Council requested that training sessions be developed and delivered to all managers and supervisors on the proper method for them to bring the results of the survey back to their employees. Since the survey was broken down by work group, it was a very useful tool for the managers and employees to discuss the areas that needed improvement. The decision was made to train some facilitators within the company to assist these work groups with their feedback sessions. This has proven to be an excellent way to help keep the feedback sessions focused on improvement. These sessions have proven quite effective in improving communications between management and employees, and has also given the employees the opportunity to have some input into how the company can solve several of these problems. After all feedback sessions are conducted and time is set aside to solve the problem areas, the company intends to conduct another survey to evaluate how effective the company's improvement efforts were in addressing employees' concerns.

Contact for More Information:

Gil Patton
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CATEGORY: Top Management Leadership and Support

10. MAINTAINABILITY AND MAINTENANCE PLANNING (M&MP) PROGRAM DEVELOPMENT

Kennedy Space Center (KSC)

Description of the Activity:

The M&MP Program was developed to implement, manage, and control the application of maintainability at the KSC. This involves creating the policy, plans, procedures, and techniques needed to perform maintainability on flight hardware, Ground Support Equipment (GSE), facilities, and equipment.

The KSC M&MP Working Group was established to aid in improving the effectiveness and efficiency of Shuttle processing and maintenance. Because of their efforts, KSC was named by NASA headquarters as the "Center of Excellence" for M&MP.

A KSC Management Instruction (KMI) on maintainability is currently being staffed, and the KSC STA-40 Space Station (SS) Maintainability Plan is in draft. A maintainability checklist for Space Shuttle GSE and facilities has been created and is currently in use at all Space Shuttle design reviews. A guidebook or handbook on performing and documenting Shuttle M&MP assessments on existing flight hardware, GSE, facilities, and equipment is also in draft. Discrete projects have been initiated such as Vibration Trend Analysis and Ferrography to be used on the Shuttle and Space Station programs. The Safety and Reliability Engineering Division has assisted Headquarters, other NASA Centers, and the Performance Enhancement Team (PET) in their efforts to create design handbooks, requirements documents, and other engineering changes to improve the overall M&MP activities throughout NASA.

Benefits Achieved:

Establishment of a much needed discipline in the Space Shuttle design and Space Transportation System (STS) operation activities ensures ease of maintenance, reduces life cycle costs, and improves ability to meet schedules. Also, the establishment of the Maintainability guidelines and requirements has helped organize the overall Maintainability activity at KSC.

Contact for More Information:

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CATEGORY: Top Management Leadership and Support

11. CENTER TOTAL QUALITY MANAGEMENT (TQM) INITIATIVES

Langley Research Center (LaRC)

Description of the Activity:

A Division Chief's Forum was established in August 1990, composed of all Center division chiefs. The forum meets quarterly with the purpose of sharing successes, lessons learned, and to work significant Centerwide issues.

Several key speakers were invited to address the Director's senior staff on TQM activities within their respective organizations. In February, Dr. Scott Sink, Director of the Virginia Productivity Center in Blacksburg, Virginia presented an overview as a result of his extensive consulting activities. In October, Mr. Robert Young, President, Lockheed Engineering and Sciences Company at Houston, Texas shared the many benefits of applying TQM in his company, which is a prime contractor to both the Johnson Space Center and the LaRC.

Benefits Achieved:

Strategies for successful management were provided by the more senior division chiefs for possible implementation in other divisions. The group also discussed innovative ways to motivate employees and to maximize flexibility in the existing, incentive awards systems. Communications across functional lines have also been improved.

The TQM results candidly shared by these two well known presenters greatly enhanced the appreciation of ongoing TQM efforts and identified areas of possible local emphasis by the Center senior managers.

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CATEGORY: Top Management Leadership and Support

12. FORMATION OF THE LANGLEY CONTRACTOR STEERING COUNCIL

Langley Research Center (LaRC)

Description of the Activity:

On November 7, 1990, the first meeting of the major Langley support contractors was held to consider establishing a local Contractor Steering Council. Representatives from 13 support contractors attended together with members of the Industry Relations Office, the Deputy Director of Management Operations, and the Center's Productivity Focal Points.

The Center Director welcomed the group and expressed his personal interest in exploring the creation of such a Council. Issues of mutual concern were reviewed together with actions to further enhance the partnership of the total Center work force. Similar councils exist at most other NASA Centers. The Associate Director added his comments on the potential value and shared examples of accomplishments by councils at other centers. There was complete agreement to form a local council which will meet monthly and be co-chaired by the Associate Director and an elected contractor official. Each Directorate later designated a civil service representative manager to be a member of the Council.

Benefits Achieved:

Possible areas for study and application include:

- 1) Applicability of suggestion systems across contractor lines
- 2) Consistent application of recent furlough directives and current items such as computer security
- 3) Timely exchange of information of common interest such as wage surveys, recruiting opportunities, and environmental and educational initiatives
- 4) Improved communications.

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CATEGORY: Top Management Leadership and Support

13. MARSHALL SPACE FLIGHT CENTER STEERING COUNCIL ESTABLISHED

Marshall Space Flight Center (MSFC)

Description of the Activity:

The MSFC Continuous Process Improvement Steering Council was established on May 18, 1990, by Management Announcement (MA) 1150.1A. This Council provides guidance, motivation, and oversight to the Center's implementation of Continuous Improvement (CI); develops and maintains a long-range process improvement plan establishing appropriate goals for the Center; and ensures a practical and effective CI effort for the Center. The Steering Council will ensure CI methods are implemented and monitored within Center organizations, component installations, and contracted efforts wherever appropriate.

The MA defines CI as a management philosophy/operating methodology totally committed to continuing improvement of all processes and products, satisfying internal and external customer needs, and fostering universal participation and teamwork. Membership on the Steering Council, which is chaired by the Center Director, consists of the top managers of the Center.

Benefits Achieved:

The establishment of the MSFC CI Steering Council emphasizes the high priority that MSFC places on continuous improvement and the commitment that each Center senior manager has to making this effort a success.

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CATEGORY: Top Management Leadership and Support

14. ISSUANCE OF NASA MANAGEMENT INSTRUCTION 1270.2

NASA Headquarters (Code QB)

Description of the Activity:

NASA Management Instruction (NMI) 1270.2 on Agencywide Total Quality Management (TQM) was issued by the Administrator on February 1, 1990. This NMI establishes NASA policy and responsibilities for TQM.

The NMI directs each installation and Headquarters to actively develop and pursue an approach to TQM based on ten basic elements: 1) top management leadership and support, 2) setting team goals and promoting world-class levels of quality and performance, 3) supporting new technology and modernization, 4) creating an innovative and challenging team climate, 5) using participative management techniques to increase individual and team contributions, 6) developing effective communications among employees, contractors, and customers, 7) promoting and stimulating individual involvement, 8) increased commitment to education and training, 9) developing and implementing means to evaluate team performance, and 10) focusing on the customer. Further guidance is provided on the roles and responsibilities for all NASA employees in carrying out this directive.

Benefits Achieved:

NMI 1270.2 formally established NASA policy and responsibilities for agencywide TQM, and provides a point of departure for further TQM implementation.

Contact for More Information:

Joyce Jarrett
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CATEGORY: Top Management Leadership and Support

**15. NASA ADMINISTRATOR LEADS SEVENTH ANNUAL NASA/CONTRACTORS
CONFERENCE ON TOTAL QUALITY LEADERSHIP**

NASA Headquarters (Code QB)

Description of the Activity:

NASA Administrator Richard H. Truly articulated NASA's top management leadership and support for Total Quality Management (TQM) during his keynote address at the Seventh Annual NASA/Contractors Conference on Quality and Productivity, held October 24-25, 1990. This event, hosted by the John F. Kennedy Space Center, drew over 750 top leaders and representatives from government, industry, and academia together to discuss TQM principles, lessons learned, and strategies for implementation. Admiral Truly stated in his address that "Each of us must be committed to total quality leadership in everything we do...Leadership, Quality, and Excellence will be key to this new age."

Attendees from approximately 275 organizations were provided with presentations from 73 panel and keynote speakers who lead quality efforts nationally and in their respective organizations. This event was NASA's first conference aimed as a tutorial in the elements of TQM.

Benefits Achieved:

These annual events provide a forum for the NASA/contractor team to share implementation strategies and lessons in quality and productivity improvement. This year's focus, with its emphasis on TQM, further supported NASA's commitment to TQM implementation throughout the organization, and its support of TQM implementation with its contractor organizations.

By basing the agenda around the elements of TQM, the attendees were provided with a tutorial of the TQM process and gathered useful information to take back to their organizations. They were also provided with the opportunity to establish contacts with government, industry, and academia, to facilitate the TQM implementation process. Post-conference surveys indicate the highest satisfaction level with the content of the presentations.

Contact for More Information:

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CATEGORY: Top Management Leadership and Support

16. TOTAL QUALITY MANAGEMENT (TQM) SELF ASSESSMENT PROGRAM

NASA Headquarters (Code QB)

Description of the Activity:

Designed as a survey instrument to provide a current "snapshot" of the degree of TQM implementation at NASA, and to aid in assessing readiness to apply for the 1991 President's Award for Quality and Productivity Improvement, the 1990 TQM Self Assessment was designed to closely model the criteria and scoring guidelines for the President's Award. The President's Award is predicated upon eight aspects, or elements, of an organization's continuous quality improvement. Seven of these eight elements form the foundation of the 1990 TQM Self Assessment, and each NASA installation was asked to rank their operation on a scale of level 1 (low) to level 5 (high), based on the criteria provided, and submit results to Code QB. Level 1 implied that little TQM implementation has taken hold, and level 5 indicates the complete integration of TQM principles and practices across the Agency.

A meeting sponsored by the NASA Office of Safety and Mission Quality, NASA Quality and Productivity Improvement Programs Division was held to review the process employed and results generated from the 1990 Self Assessment, to review the criteria for the 1991 President's Award for Quality and Productivity Improvement, to analyze TQM performance and integration throughout the Agency and identify appropriate strategies for improvement, and to assess Agency readiness to apply for the President's Award.

Benefits Achieved:

The results of the 1990 TQM Self Assessment were viewed as a fairly good baseline for measuring current TQM implementation and integration efforts within NASA installations. The Self Assessment working group produced a report of output reflecting their recommendations as to where NASA should direct future TQM implementation efforts, both agency wide and at individual centers.

Contact for More Information:

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CATEGORY: Top Management Leadership and Support

17. NASA SPACE GRANT RESEARCH AND FELLOWSHIP PROGRAM

NASA Headquarters (Code QR)

Description of Activity:

Code QR concentrated on approaches to expand existing space grant consortia to include qualified historically black colleges and universities and universities with large minority student enrollments. Aspects of the Space Grant Research and Fellowship Program are geared toward encouraging more women and minorities to become interested in careers in mathematics, science, and space. Code QR is working closely with the Educational Affairs Division (Code XE) to develop new approaches to reach students in the K-12 grades and to encourage and promote an early interest in science and space.

Benefits Achieved:

The expansion of the number of colleges and universities participating in the NASA Space Grant Research and Fellowship Program means that the benefits of the program becomes available to a broader base of students while promoting career development and graduate research opportunities in space, science, and engineering. Specific results and benefits achieved to date include the following:

1. Established District of Columbia Space Grant Consortium:
 - Howard University (Lead Institution)
 - George Washington University
 - Georgetown University
 - University of the District of Columbia
2. Lincoln University (Pennsylvania) will become a full member of the Pennsylvania State University Consortium.
3. Bethune Cookman College will become a full member of the Florida Space Grant Consortium.
4. State University of New York at Albany and City University of New York will become full members of the New York Space Grant Consortium (Cornell).

Contact for More Information:

Louis Clark
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CATEGORY: Top Management Leadership and Support

18. STILL VIDEO IN SUPPORT OF NASA SRM&QA DECISION-MAKING PROCESS

NASA Headquarters (Code QT)

Description of Activity:

Code QT, in its leadership role for SRM&QA decision support systems, sponsored the acquisition of equipment for the transmission and receipt of still video images between Headquarters, JSC, KSC, and MSFC. Included in the systems is a still video camera located within SRM&QA at KSC. The still video camera instantly stores full color pictures on a two inch floppy diskette in the camera. The diskette can then be inserted into the transceiver equipment and the images can be very quickly transmitted over the telephone lines to the other sites.

Benefits Achieved:

The still video "system" established is used to support the SRM&QA decision-making process. Pictures of "problem" hardware at KSC can be instantly shared with the SRM&QA community at Headquarters, JSC, and MSFC. This is particularly valuable in the context of SRM&QA Pre-launch Assessment Review process--a number of teleconferences leading up to discuss the level of risk associated with each manned space flight. The use of still video in the PAR has added a new dimension of fidelity to what was formerly a one-dimensional, audio and viewgraph only, meeting. The old adage of "a picture is worth a thousand words" is clearly making a big comeback in the realm of SRM&QA decision-making.

Contact for More Information:

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CATEGORY: Top Management Leadership and Support

19. IMPLEMENTATION OF AN OFFICE OF THE INSPECTOR GENERAL (OIG) TOTAL QUALITY MANAGEMENT (TQM) PROGRAM INVOLVING ALL OIG CENTER OFFICES AND HEADQUARTERS

NASA Headquarters (Code W)

Description of the Activity:

The OIG has initiated an active TQM program on a two-tier level. TQM councils have been formed at each OIG center office and OIG Headquarters as one level and an OIG-wide TQM council has been formed as the second level. Each council has members representing each functional discipline (audits, investigations, and support). Training has been conducted in both TQM awareness and TQM facilitation. Center councils have already begun to identify potential process improvement initiatives. The program could not have been so quickly implemented at the "grass roots" level without the full support and commitment of OIG top management.

Benefits Achieved:

The Center's councils have begun to identify process improvement initiatives in both the investigative and audit areas. Currently, expectations are that several staff days will be saved in the reporting cycles for both functional areas at each Center office.

Contact for More Information:

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CATEGORY: Top Management Leadership and Support

20. TOTAL QUALITY MANAGEMENT (TQM) PARTNERSHIP IN ACTION

Stennis Space Center (SSC)

Description of the Activity:

SSC, in conjunction with its contractor, World Services, Inc., initiated a TQM Leadership Council in October 1990. The Council (representative of all divisions and staff areas) has been trained in TQM philosophy/concepts, organizational change, communication skills, team building, and group process skills. They have developed mission and philosophy statements, stated goals and objectives, provides action guidelines, and developed team ground rules. The Council will assist the Performance Management Office in training all employees in TQM philosophy and concepts, develop TQM curriculum/courses leading to certification, establish performance standards for all employees, develop employee recognition/award system for continuous improvement, develop a five-year strategic plan, implement four more self-managing teams, and achieve three Quality/Excellence Awards.

Benefits Achieved:

The Leadership Council is instrumental in nurturing the TQM philosophy throughout the organization and provides a forum where company and union employees can simulate, understand, and endorse TQM concepts.

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STRATEGIC PLANNING

CATEGORY: Strategic Planning

**21. 1990 FALL RETREAT ENGINEERING DIRECTORATE ISSUES, CONCERNS,
AND OPPORTUNITIES**

Goddard Space Flight Center (GSFC)

Description of the Activity:

A two-day retreat was held to conduct strategic planning for the Engineering Directorate. The participants included the Directorate staff, all Division Chiefs and their associates. All participants generated their concerns before the retreat and an agenda was formulated. These issues were discussed at the retreat and working committees were established to meet the objectives of the Directorate.

Benefits Achieved:

The major benefit that derived from the retreat was the establishment of working groups to deal with the primary issues and concerns of the Directorate. These committees are working on the following:

- 1) A scheduling and cost tracking approach improvement to complement technical management;
- 2) An improved planning process to assess the impact of new assignments on the organization in terms of staffing, resources, and long-range goals;
- 3) Improvement of on-the-job training;
- 4) Methods for reducing/controlling flight hardware development costs to maximize flight opportunities; and
- 5) Improve communication within the Directorate.

The establishment of a monthly newsletter from the Deputy Director of Engineering to all directorate employees has already been implemented. This newsletter is a status report on the latest events within the organization and is intended to keep the flow of communication open from the top down.

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Allan Sherman
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CATEGORY: Strategic Planning

22. INTEGRATED SERVICES DIGITAL NETWORK (ISDN) DEPLOYMENT

Jet Propulsion Laboratory (JPL)

Description of the Activity:

The deployment of a testbed configuration on October 15, 1990, provided JPL an opportunity to become a national leader in the emerging telecommunications technologies known as Integrated Systems Digital Network, or ISDN. The JPL is expected to deploy approximately 1,000 lines of ISDN in the next few years and is the first Pacific Bell ISDN customer. As a heavily networked scientific and engineering community, our data requirements are challenging the state of the telecommunications industry, and being the sole user of the Northern Telecom DMS 100 digital telephone switch with over 13000 voice lines, we are in an unique position to act as an operational catalyst for all aspects of the ISDN industry. We have developed a team approach with Pac Bell, Northern Telecom, ISDN vendors and various standards, committees, and interest groups, and have created test and demonstration laboratories to facilitate the coordination needed to further the advance of the telecommunications industry.

Benefits Achieved:

Implementation of ISDN allows JPL to address the voice and data requirements of new or recently moved personnel as one issue. Using the existing telephone lines for simultaneous voice and high speed data circuits results in cost savings in both areas. But the real value to the Laboratory with the ISDN Advanced Telecommunication Project is a migration which will enable JPL to manage our contribution to an estimated increase in NASA's total annual data accumulation of 4,200 terabits by the end of the decade (see Figure A-1).

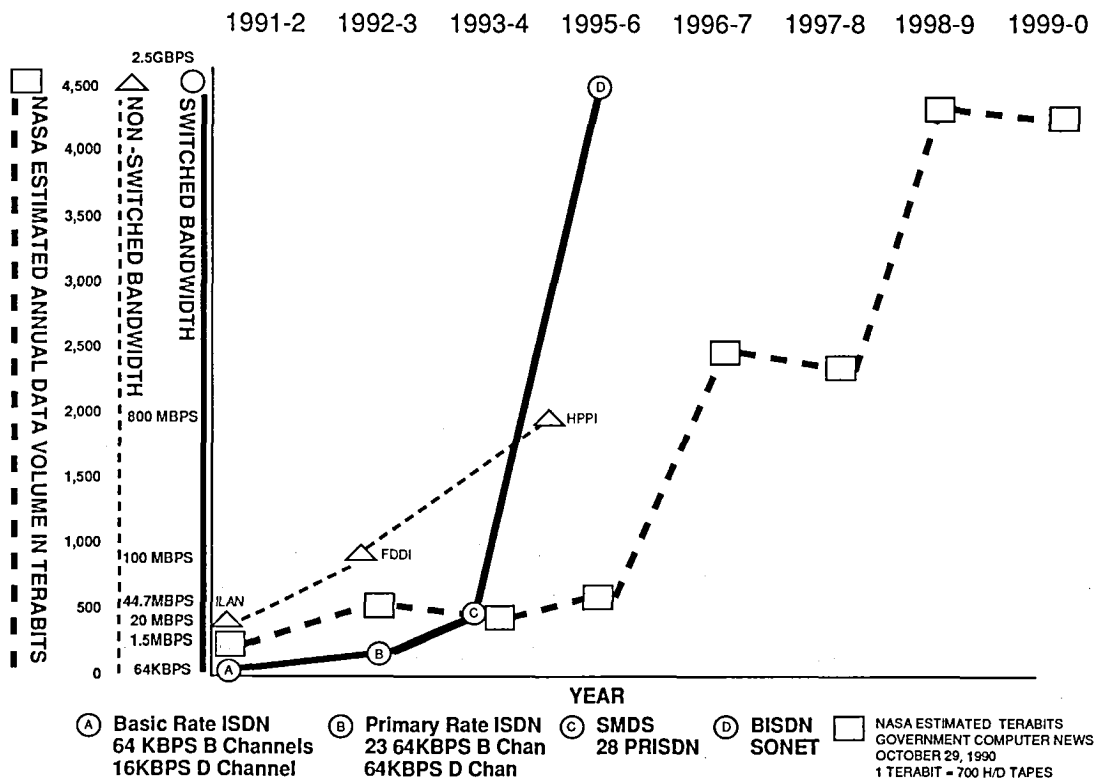
Contact for More Information:

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FIGURE A-1

III. Vision for the Future

EVOLUTION OF COMMUNICATION BANDWIDTHS



jj-12-04-90

CATEGORY: Strategic Planning

**23. SPACE EXPLORATION INITIATIVE STRATEGIC PLANNING AND
MANAGEMENT DESIGN**

Johnson Space Center (JSC)

Description of the Activity:

The Space Exploration Initiative (SEI) presents an enormous technological, managerial, and scientific challenge for NASA that will continue into the 21st Century. In order to understand the implications of this major undertaking, a team of experts was assembled representing most NASA Centers to:

- 1) Envision the scope and magnitude of the program
- 2) Develop concepts, scenarios, programmatic analyses and conceptual designs of candidate hardware items, and
- 3) Develop meaningful program plans.

A number of historical program models were studied and common elements in successful programs identified such as: using new, streamlined organizations rather than established bureaucracy; establishing short schedules consistent with technological readiness; utilizing private sector competition in the development process; and minimizing government contractor interfaces. Results were shared with highest level managers in the program and accepted as a model for SEI.

Following this activity, a series of educational seminars for all staff members covered the basic sciences involved in the exploration process and the basic principles of successful program and risk management. Four groups were established to provide skills and expertise from across the Agency for continued program planning and implementation; a Program Review Board and advisory body, and working groups for flight design, operations concept, and management systems.

Benefits Achieved:

The team processes utilized have resulted in a far better understanding of program requirements, more common vision and greater unanimity of purpose. Although most of the benefits of the strategic planning activity will be realized in future years, it has already helped to focus the limited funding available for advanced development and technology for a potential savings of several hundred million dollars.

Contact for More Information:

Humboldt Mandell
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CATEGORY: Strategic Planning

24. INSTRUMENT RESEARCH DIVISION (IRD) STRATEGIC PLAN

Langley Research Center (LaRC)

Description of the Activity:

The IRD of LaRC developed a strategic plan to more effectively manage:

- 1) The expected increased demand for measurement technology and services by LaRC aeronautics and space research disciplines
- 2) The sophisticated research and applications programs responsive to the complex nature of upcoming measurement requirements, and
- 3) The constrained staff and funding resources expected to be available.

In carrying out the strategic planning process, division personnel identified needed technical measurement capabilities, those whose achievement is currently funded, as well as those currently unfunded. Langley research division managers (representing IRD's "customers") presented perspectives on their technology areas, focusing on anticipated IRD measurement technology and instrumentation/service needs. These managers reviewed initial drafts of the resultant strategic plan, and provided their priorities for the ongoing and proposed IRD technical achievement plans. In addition to the enhancements in the division's measurement technology capability, the strategic plan addressed IRD operations, considering improvements in such factors as instrument out-of-service time and internal workload handling. Finally, the division organization and its personnel were addressed, highlighting advancements in professional development and training currency, technical conference participation, and awards and recognition for job performance.

Benefits Achieved:

Benefits achieved include:

- 1) Clear communication to Center management of IRD capabilities and directions for the future
- 2) Establishment of a strong dialogue between IRD as "instrumentation service" supplier and other Langley research organizations as "customers"
- 3) Identification of instrument support areas (for which IRD is responsible) where tangible savings in time or resources can be realized
- 4) Through participation in and implementation of the strategic planning process enhanced intradivisional communications and coordination/cooperation resulting in more efficient accomplishment of multidiscipline measurement tasks, and
- 5) Promotion of excellence by improvement of the division's human resources through added emphasis on technical development and recognition of all employees.

Contact for More Information:

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CATEGORY: Strategic Planning

25. APPLICATION OF TAGUCHI DESIGN OF EXPERIMENTS TO TECHNICAL TEST BED TEST PLAN FOR SPACE SHUTTLE MAIN ENGINE (SSME) 3001

Marshall Space Flight Center (MSFC)

Description of the Activity:

The SSME Test Approach and Plan was developed using Total Quality Management principles. Specific Test Plan Design Criteria were developed from a systems perspective. The SSME 3001 Test Plan includes use of the Taguchi method to determine which controllable engine parameters cause the fuel flow rate into fuel pre-burner to vary, and determine the magnitude of each parameter's contribution to that variance. This information aids the SSME power balance model in the prediction of pump and engine performance.

Benefits Achieved:

With application of the Taguchi matrix, the number of main stage tests planned was reduced from 6 to 5 without compromising any objectives. In fact, two significant additional objectives which were not included in the original plan will also be achieved. The cost avoidance of one main stage test encompasses the following: data storage and associated manpower including technicians, engineers, and support groups.

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CATEGORY: Strategic Planning

26. OFFICE OF SPACE FLIGHT (OSF) NETWORK INTEROPERABILITY

NASA Headquarters (Code M)

Description of the Activity:

As part of the implementation of our new Management Information Systems (MIS), Code M is leading several activities in the area of computer networking. Users at Code M Headquarters interface daily with OSF programs and Center personnel. They use the OSF Network to perform activities such as creating budget reports, status reports, graphics charts, briefing reports, spreadsheets, etc.

The Code M MIS network needs to support the flow of information between Headquarters and the OSF centers. The Code M network was strategically designed to be open and provide easy access. The strategy was simple: adhere to standards and make maximum use of existing equipment. Code M is the first major Local Area Network (LAN) at OSF that connects PC and MacIntosh workstations using a standard set of protocols (TCP/IP). Other OSF LANS were proprietary protocols (MacIntosh Appleshare, PC Novell, PC XNS). The implementations of Transmission Control Protocol/Internet Protocol (TCP/IP) allowed Code M to easily integrate Space Station users with Code M, and connect OSF Centers, MSFC, JSC and KSC to Code M LAN. Our second strategic criteria was to make maximum use of existing equipment. We could not afford a design that requires replacement of all network equipment for the entire community of OSF PC users (several thousand users). Another example of our strategic thinking was to use the Program Support Communications Network (PSCN) and its services, rather than use dedicated phone lines.

The use of strategic planning will help us in our near term future activities. The design for the new NASA Headquarters building networks is one that Code M can fully take advantage of, as it is based on TCP/IP. TCP/IP can provide easy migration to the new Government network standard.

Implementing strategic thinking by using standards is only a partial explanation for the successful implantation in Code M Network. A second, and no less important, TQM category we adhered to was teamwork. Throughout the design of our MIS, we included Code DT, OSF centers and various contractors. Center people got involved very early in the design and were part of the team during implementation. We feel that the success of our MIS was due to TQM thinking, application, and implementation. We will continue implementing TQM and help others do likewise.

Benefits Achieved:

We provided Space Station users, in the fifth floor at NASA Headquarters, easy access to Code M Budget and Action Tracking Systems. Space Station users will be part of the Code M LAN and will also have full compatibility with Space Station Technical and Management Information System (TMIS).

For Space Station users in Reston requiring access to Code M hosts we implemented a Pilot using TCP/IP. We are currently expanding the pilot capability to 30 users. These users can access both TMIS and Headquarters systems in an easy and user-friendly fashion.

Code M is the first node of TMIS to SSFPMAIL using TCP/IP. Once this capability is successfully implemented, the Johnson Space Center (JSC) and the Marshall Space Flight Center (MSFC) nodes of SSFPMAIL will move to TCP/IP. This will allow TMIS users in JSC and MSFC to take advantage of local Automated Data Processing (ADP) services provided by the Institution. For example, at JSC Space Station users with TCP/IP will be allowed to use the JSC Campus Fiber cable.

As part of Monthly Associated Administrator Reported System (MAARS), workstations located at OSF centers have easy and user-friendly access to Code M Headquarters servers. For example, users at MSFC move files to the Headquarters server using the DOS copy commands, and as a result they can print directly on printers located at Headquarters.

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CATEGORY: Strategic Planning

27. OFFICE OF SPACE FLIGHT (OSF) PLANNING PROCESS

NASA Headquarters (Code MB)

Description of the Activity:

In July, the OSF Associate Administrator approved a new process for developing and implementing a long-range plan. This new process is a top-down review of the OSF mission, the underlying factors affecting OSF activities, the major office objectives, and the strategy for accomplishing these objectives. This process involves senior representatives from all OSF programs and from OSF-administered Field Centers. The initial plan will be issued in June 1991.

Benefits Achieved:

This process will ensure that the OSF mission is accomplished in the most cost-effective way. The plan will permit OSF management to monitor the accomplishment of office objectives and coordinate the planning, development, and operation of multiple programs to accomplish OSF's mission. The process will also establish a common direction across OSF and provide members with an understanding of the complete OSF mission and responsibilities.

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CATEGORY: Strategic Planning

28. THE OFFICE OF SPACE SCIENCE AND APPLICATIONS STRATEGIC PLAN

NASA Headquarters (Code S)

Description of the Activity:

The Office of Space Science and Applications (OSSA) has produced a strategic plan since 1988, as a mechanism for expressing a coherent vision of the NASA Space Science and Applications program, along with a clear statement of the decision rules which will determine mission selection. The document is revised annually, with the participation and active support of the science community. In its current form, the OSSA Strategic Plan addresses the science objectives of the Agency, across each of the discipline areas, as reflected in the five-year program; the environmental factors which are expected to affect implementation of those objectives; and the procedural rules by which missions will be selected for flight.

Benefits Achieved:

The OSSA Strategic Plan provides an agreed sequence of science and applications missions which address, in equitable, priority order, the major objectives of the principle disciplines. The Plan supports defense of the NASA budget on the Hill by offering a coherent program which is both interrelated and has the support of the science community. The Plan represents an agreed baseline from which internal management decision-making can begin. The Plan provides a clear statement to potential foreign partners of the directions and pace of the NASA science program, which can be used to identify potential cooperative opportunities which are consistent with foreign planning.

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CATEGORY: Strategic Planning

29. COMMUNICATIONS REQUIREMENTS FORECAST (CRF)

Stennis Space Center (SSC)

Description of the Activity:

Stennis Space Center (SSC) Communications conducts an annual survey of all resident agencies to determine their five year forecast of communications requirements. The CRF is the vehicle for accomplishing this survey. Data accumulated from this survey is compiled, evaluated, and incorporated into a five year Communications Strategic Plan, which constitutes the basis for formulation of the Communications Requirements for the annual Program Operating Plan/Institutional Operating Plan submittal.

Benefits Achieved:

Prior to implementation of the final phase of this activity in 1990, strategic planning for establishing the Center's Communications Requirements was virtually non-existent. All communications activities were conducted in a reactive mode, which was inefficient and not cost effective. Adoption of the CRF has allowed evaluation, prioritization, and budgetary planning to effectively meet the present and future needs of a rapidly growing center.

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CATEGORY: Strategic Planning

30. STRATEGIC/OPERATIONAL PLANNING RETREAT FOR PERFORMANCE MANAGEMENT

Stennis Space Center (SSC)

Description of the Activity:

The Performance Management team met off-site to discuss barriers to the productivity and quality of SSC contractors employed by World Services, Inc. The barriers were identified and goals, objectives, and action plans were developed to eliminate these barriers. Topics covered include: team leader, member, and recorder training; strategic planning; customer satisfaction (internal and external); performance standard development and measurement; development of a TQM Leadership Council and an Ethics Committee; facilitator training; community involvement; and Total Quality Management (TQM) certification programs.

Benefits Achieved:

The planning and implementation of TQM programming has taken place in an orderly fashion. The Ethics Committee has been reorganized and implemented and "Excellence in Customer Satisfaction" training is nearly completed for top management.

Contact for More Information:

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CATEGORY: Strategic Planning

31. STRATEGIC PLANNING TO INCORPORATE TOTAL QUALITY MANAGEMENT (TQM)

Stennis Space Center (SSC)

Description of the Activity:

In fiscal year 1990, the General Manager of Sverdrup Technology, Inc., an SSC contractor, decided to adopt TQM into SSC's group activities. A Sverdrup Strategic Plan has been created with several TQM goals and objectives. The two most important, and completed, goals include the adoption of a TQM Policy and the establishment of a TQM Steering Committee.

Benefits Achieved:

TQM has been officially kicked off in 1990 as part of the SSC Group. Both of these goals have been implemented. The Steering Committee is meeting to formulate a fiscal year 1991 action plan. Top management had communicated an interest and commitment to implementation of TQM

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FOCUS ON THE CUSTOMER

CATEGORY: Focus on the Customer

**32. SCIENTIFIC AND TECHNICAL ELECTRONIC PUBLISHING SYSTEM
(STEPS)**

Ames Research Center (ARC)

Description of the Activity:

STEPS is ARC's innovative automated system to improve the quality, production process, management and tracking of technical reports, documents and presentation materials. STEPS is a networked electronic platform for the entire publishing operation, and includes a disparate group of hardware, software, peripherals, and networks. Tracking and document work flow are managed by an important subsystem, the STEPS Tracking and Retrieval Systems (STARS).

ARC has over 1,000 research engineers and scientists located at its two sites, the Moffett group at Moffett Field in Mountain View, California and the Dryden group at Edwards Air Force Base, California. This staff produces more than 500 publications every year, which require the preparation of about 10,000 illustrations.

STEPS has been developed to improve the quality, timeliness and quantity of these publications. In addition, the management issues of producing these documents has also been improved. The STARS Data Base not only allows for storage, retrieval and archiving of the many components of each publication, including the text files and the various graphics, but also includes other data needed to track the progress of the production of these components. Work assignment and progress, editorial changes, and due dates are just some examples of other information stored in STARS and available to the managers, authors, editors, artists and other personnel involved in the production of complex reports.

STEPS has been under development for over three years. The majority of the hardware, software, and procedures have been in use for a length of period (approximately two years) that noticeable improvements are already being seen in the quality and timeliness of reports. The final installment - the STARS Data Base - is now in place and is being used in a Beta test version; it will be fully operational in 1990. Additionally, most of STEPS has been built using off-the-shelf components, such as MacIntosh personnel computers, standard graphics, text processing packages, and easily obtained peripherals - printers, scanners, network components, etc. Even the STARS Data Base has been developed using a commonly available Data Base Management System. This design goal will allow for on-going, low-cost improvements and enhancements in the features and capabilities of STEPS.

Benefits Achieved:

The driving force behind efforts in this area has been to improve the quality and timeliness of publishing technical documents. The beneficiaries are the internal customers - the researchers - as well as the external customers - the research community and the public.

The development of STEPS has been centered at the Dryden Flight Research Facility, since it is a smaller organization and includes both publications and graphics in the same branch. This arrangement has allowed for the development and check-out in a prototype-like environment with a close-knit group that has been very enthusiastic in bringing this system on line. The benefits that will be mentioned are for the Dryden publications only.

The accompanying chart, titled Timeliness (see Figure B-1), shows the publication of three reports of similar size and complexity that have been produced in the last several years. The first report was done before STEPS, the second one was done during the very early stages of STEPS, and the third report was done just recently using the current STEPS. The improvement in publication time - from 3.2 years to 1 year - is quite significant. When normalized to factor in the increased number of pages, the improvement is even more striking.

The chart titled Quantity (see Figure B-2) shows the number of publications and graphics for the last several years including fiscal year 1987, which is pre-STEPS. Of course, the number of reports published is limited to the number written, but there has been a definite increase. The number of graphics is also significant. The number of graphics being produced has increased by 50 percent with no increase to the staff. The number of graphics completed exclusively on the MacIntosh has grown to about 80 percent of the total, whereas before they were all done on drafting tables. This has resulted in a greater portion of the graphics being used over again in follow-on publications or presentations and has eliminated much rework.

The quality of publication is difficult to measure, but easy to see. The chart titled Quality (see Figure B-3) shows samples from both pre and post STEPS reports. The improvement in quality is evident. The early document was done using the then available word processors and hand paste-up methods, while the latter document was done using STEPS. This factor has to help improve the Agency's image to persons in the research community who read these reports.

Other benefits of using STEPS include:

- 1) Transferability - nearly all text and about 50 percent of artwork are now submitted in electronic form - from a wide variety of PC's, workstations, and computer platforms, and
- 2) Accessibility - STARS and networking capability in development to allow network access (to authors, editors, etc.) to archives and information concerning progress of publications.

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FIGURE B-1

Timeliness

NASA
AD90-448

Authors/content	Report	Received	Published	Elapsed time, yr	Normalized time
Meyer, Covell 56 pages + 604 microfiche 660 total pages	TP-2619	7-83	9-86	3.2	3.2
Anderson, Meyer 42 pages + 2288 microfiche 2330 total pages	TM-101712	12-88	5-90	1.5	0.4
Anderson, Meyer 34 pages + 2844 microfiche 2878 total pages	TM-101701	6-89	6-90	1.0	0.2

FIGURE B-2

Quantity

NASA
AD90-446

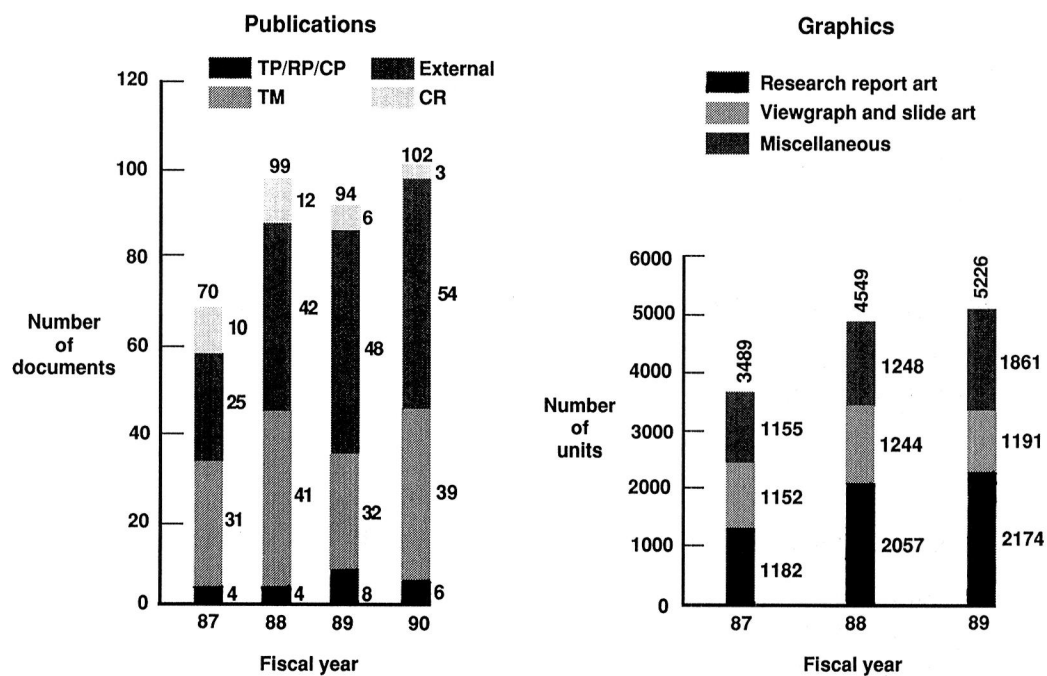


FIGURE B-3

Quality

NASA
AD90-447

Pre-STEPS

STEPS

NOMENCLATURE

The results presented in this report are referenced to the stability-axis system for the aircraft longitudinal aerodynamic characteristics. Wing and winglet force and moment data have been reduced to

c_{avw}	average chord of reference winglet planform, s_w/h , 4.01 cm (1.68 in)
C_{Bw}	winglet bending moment coefficient obtained from integration of winglet load distribution, $\frac{\text{bending moment}}{q_\infty s_w h}$, $\int_0^1 \left(\frac{z}{h}\right) \left(\frac{c}{c_{avw}}\right) (c_n) d\left(\frac{z}{h}\right)$
C_L	total lift coefficient, $\frac{\text{lift}}{q_\infty S}$
c_m (CM)	section pitching-moment coefficient obtained from integration of section pressure distributions, $\frac{\text{moment}}{q_\infty c}$, about 0.25c, $\int_0^1 (c_{pl} - c_{pu}) \left(\frac{x}{c}\right) d\left(\frac{x}{c}\right)$
C_{Nw}	winglet normal-force coefficient obtained from integration of spanwise load dis-

m , where n_p is the number of measurement points of the physical coordinates; $[\phi]$ is of the order $n_p \times n$ and $[q]$ is of the order $n \times m$.

Formulation of the Flutter Equations

As already stated, the formulation of the flutter equations is constrained to equations with real coefficient matrices, following the aforementioned sensitivity to errors of the measured responses. The structural equations of motion can easily be brought to the form of equation (1). There remains to treat the aerodynamic coefficient matrix. This matrix is a function of the flight Mach number, the reduced frequency k , and the flight dynamic pressure Q_D . For any specific Mach number, the aerodynamic matrix $[A]$ can be approximated by the following Padé relation:

$$[A] = Q_D \left([A_0] + [\bar{A}_1] ik + [\bar{A}_2] (ik)^2 + \sum_{j=3}^{\ell} \frac{[\bar{A}_{2+j}] ik}{ik + \beta_j} \right) \quad (16)$$

If one ignores all of the lag terms, equation (16) assumes the form

$$[A] = \frac{1}{2} \rho V^2 [A_0] + \frac{1}{2} \rho V [A_1] i\omega + \frac{1}{2} \rho [A_2] (i\omega)^2 \quad (17)$$

CATEGORY: Focus on the Customer

33. SPACE EXPLORATION INITIATIVE (SEI) AEROBRAKE TECHNOLOGY TRANSFER

Ames Research Center (ARC)

Description of the Activity:

A day long exchange of information was held between ARC Thermosciences Division personnel and representatives from the Martin Marietta Astronautics Group of Denver. Martin Marietta is planning to fund Aerobrake studies in 1991 in the areas of systems studies, aerothermodynamics, guidance/navigation and control, and structure and thermal protection materials. Martin Marietta's representatives visited ARC in an effort to better understand the state-of-the-art developments, and their interest and participation was a direct response to the technology workshops previously conducted by ARC in 1989 and 1990.

Benefits Achieved:

ARC was able to enhance the Martin Marietta knowledge base in the following ways:

- 1) ARC's adaptive grid Computational Fluid Dynamics (CFD) package was given to Martin Marietta's Aerothermodynamists. This will greatly improve the accuracy of Martin Marietta's CFD results and will reduce considerably the amount of computing they require for flow field simulations
- 2) The State-of-the-art real-gas flow field codes available at ARC were identified. Martin Marietta expressed a desire to come to ARC, work with the code on-site, and then transport the code back to Martin Marietta
- 3) Martin Marietta expressed a need to know shock layer turning angles for the blunt aerobrakes for their design studies. Martin Marietta was given a white paper advocating the need to measure wake unsteadiness on the AFE vehicle, which contained the current body of knowledge on the turning angles.

- 4) Martin Marietta indicated they will be spending about one (1) man year compiling information on currently available thermal protection materials. This work had already been done by the materials group in the Aerobrake Technology team. Martin Marietta was told how to obtain a copy of the compilation for free from the Johnson Space Center.

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CATEGORY: Focus on the Customer

34. MAINTENANCE AND USE OF MILITARY SURPLUS MOTOR AND HARDWARE INVENTORY BY THE NASA SOUNDING ROCKET PROGRAM EXPEDITES LOW COST QUICK RESPONSE FOR SCIENTIFIC COMMUNITY

Goddard Space Flight Center (GSFC)

Description of the Activity:

The NASA Sounding Rocket Program is dynamic in nature with scientific opportunities, payload weight, size, and other variables dictating the type and configurations of rocket motors that are used. Surplus military motors are used in 13 of the 15 sounding rocket launch configurations. Use of these surplus motors enables the program to operate at a very low cost to the government. To maintain our program as a quick response, low cost effort, access to surplus motors is essential. Surplus motors are obtained from various military sources on an "as Available" basis. Maintaining an inventory that often exceeds the projected immediate need for support of long range considerations is a necessary feature. This inventory that requires exception to normal storage and quantity requirements enables the program to provide its low cost, quick response to the scientific community on a continuing basis.

Benefits Achieved:

The use of surplus motors enables the Sounding Rocket Program to operate with a high success rate at a very low cost. In just over the past decade, utilizing our surplus motor inventory, we have flown almost 400 rocket systems with a success rate of over 98 percent.

As an example, we are able to acquire refurbished surplus Terrier motors at a cost of \$11,500.00 each. The commercial equivalent would cost up to \$70,000.00 each. The program has saved over four million dollars in the past 5 years with the use of just this particular motor. We anticipate launching approximately 35 missions per year utilizing approximately 90 motors from our inventory. Additionally, the maintenance of this surplus motor stock allows quick response to our customers in the scientific and academic communities for study of unusual and unforeseen scientific phenomena. The low cost of this program allows a greater number of flight opportunities within current budget constraints.

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CATEGORY: Focus on the Customer

**35. MANAGEMENT OPERATIONS DIRECTORATE (MOD) DRAMATIC
IMPROVEMENTS IN CUSTOMER INTERFACE**

Goddard Space Flight Center (GSFC)

Description of the Activity:

Both at the Directorate level and in its individual divisions, MOD is carrying out a well-rounded TQM program. These efforts seek to enhance the organizations's effectiveness through emphasis on customer service, teamwork, improving communications, and effective involvement of employees in planning and performing the Directorate's work. Selected examples of MOD activities are as follows:

- 1) Mission Enhancement and Team-building Seminar (METS). MOD conducts METS for a broad cross section of its employees to enhance teamwork and customer service and develop a sense of belonging to the Directorate at large. This 4 day seminar is conducted three times a year for 75 MOD employees. The Directorate is considering related training programs to further emphasize these values within its workforce.

- 2) Facilities Engineering Division (FED). The FED has undertaken a complete change in its organizational culture emphasizing timely response to customer requirements, enhanced training and mentoring programs, improved communications internally and with customers, and improved delegation. Major results achieved, or underway, are a revamped small project construction contract with service incentives, a facilities guide for FED employees, a customer user guide, monthly reviews of major projects with customers, and other efforts to improve construction services.
- 3) Health, Safety, and Security Office (HSSO). The HSSO has initiated a top-to-bottom "Town Meeting" planning process to involve all employees in planning and accomplishment of office goals.
- 4) Prompt Payment Working Group. In response to serious problems in timely payment of Center bills, a team of employees from Accounting, Logistics, and Procurement worked to analyze and solve the process problems contributing to late payments. The Center's interest penalties are now among the lowest in the Agency as compared to the highest a year ago.
- 5) Plant Operations and Maintenance Division (POMD). The POMD has developed a number of initiatives including working with its large Center maintenance contractor to develop an "Engineers' Journal" for communicating Center priorities and values to contractor employees; a cooperative effort with FED and various customers to develop a plan for improving HVAC systems throughout the Center; and a Building Manager Program to provide a personalized customer interface in each of the Center's main buildings.

Benefits Achieved:

The above are excellent Management practices which focus the efforts of our employees on responsive customer service and innovative ways to deliver those services.

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CATEGORY: Focus on the Customer

36. PEGASUS SATELLITE (PEGSAT) MULTIPURPOSE SPACECRAFT

Goddard Space Flight Center (GSFC)

Description of the Activity:

The NASA PEGSAT Program focused on providing a low cost spacecraft bus which could accomplish credible scientific missions in a very timely and cost effective manner, and provide launch vehicle environment data for a new vehicle under development by industry. The PEGSAT small launch vehicle was developed by industry; supported by the Department of Defense for application to their advanced efforts; and directly applicable to meeting a variety of needs for NASA.

Benefits Achieved:

PEGSAT was designed, developed, and built in-house at the GSFC in approximately six months to answer a call from DARPA, Inc. to characterize the launch environment of the newly developed Pegasus vehicle. This effort resulted in many benefits with far reaching implications to a multitude of organizations:

- 1) The Orbital Sciences Corporation and DARPA, Inc. gained the experience of integrating a real spacecraft into this unique launch capability from a B-52 bomber, while obtaining data on the launch environment for use in designing future cost and weight efficient spacecraft. Three inert flights were conducted with the spacecraft Engineering Test Unit providing flight data and experience prior to the successful final launch.
- 2) The Department of the Navy provided a small, experimental communications satellite which was deployed into orbit by PEGSAT using a system developed for use on the shuttle.
- 3) NASA/Dryden Flight Research Facility was able to use this opportunity to verify the newly developed Computational Fluid Dynamics (CFD) analytical tool, which is intended to reduce or replace wind tunnel testing.
- 4) NASA/GSFC took advantage of building this first Pegasus spacecraft by adding a Barium Chemical release experiment which would provide a precursor for the large Combined Release and Radiation Effects Satellite (CRRES) payload which was launched shortly after this mission.

This unique, quick response mission was extremely successful and has opened the door for revisiting low cost, medium risk techniques for application to future satellite missions.

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CATEGORY: Focus on the Customer

37. NOVATION OF MARTIN MARIETTA CORPORATION SUBCONTRACT WITH BDM INTERNATIONAL, INC.

Jet Propulsion Laboratory (JPL)

Description of the Activity:

The Martin Marietta Corporation subcontract with BDM International, Inc. was innovated to JPL, effective November 23, 1990 (seven days ahead of schedule). The execution of this nonstandard Novation Agreement represented many long hours expended by the Group Supervisor, 626-3 and the Contract Negotiator Specialist assigned to the 957096 contract, along with the outstanding support from the Subcontract Review Office, Office of the General Counsel and the NASA Review Office.

Benefits Achieved:

The request to novate Martin Marietta's subcontract with BDM International was directed by the JPL All Source Analysis System (ASAS) Program Office to reduce the "non-value" added cost to the ASAS program. The anticipated savings from this novation over the life of the contract is approximately \$2 million.

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CATEGORY: Focus on the Customer

38. JOINT JSC/CONTRACTOR INITIATIVES

Johnson Space Center (JSC)

Description of the Activity:

A number of JSC organizations are pursuing joint JSC/Contractor efforts at the working level to enhance partner relationships and improve work processes. For example:

- 1) The Safety, Reliability and Quality Assurance Office (SR&QA) is working closely with its support contractor, Loral (formerly Ford Aerospace) to implement cross-functional process improvement teams involving civil service and contractor personnel. Teams are continually being formed and a seven-step methodology to guide team activities is evolving.
- 2) A Business Process Total Quality Team in the Space and Life Sciences Directorate (SLSD) is analyzing SLSD/support contractor business practices and processes. This project was selected because it involved not only JSC, but also Directorate support contractors (Lockheed Engineering and Sciences Company (LESC), GE, and Krug). In addition, the effort cuts across divisional lines in the case of LESC support to both the Solar System Exploration and Man-Systems Divisions. Particular attention is being given to such areas as the mechanization of work assignments, contract funding, technical performance measurement, and cost tracking/reporting.
- 3) The Facility Development Division in the Center Operations Directorate has initiated regular joint meetings with the Engineering Support Services contractor (Brown and Root) directed at reducing design cost. Results to date include standardization of computer-aided design (CAD) details for repetitive designs, increased use of drafting personnel to assist engineers during the design phase, and a refined drawing review process.

- 4) A Human Factors Research and Engineering group in SLSD has implemented a number of changes to strengthen the JSC/LESC team and increase focus on the group's responsibility for enhancing crew productivity and ensuring that crew interfaces to spacecraft systems are optimally designed for crew use. Team evaluation of spacecraft systems for usability was adopted; quarterly project reports were initiated to provide greater visibility of team progress; a document describing the group's capabilities was generated for distribution to potential customers; and a team-building retreat was held to increase effective group communication and the group's mission, goals, and objectives.
- 5) The Problem Report and Corrective Action (PRACA) system, which is managed by JSC SR&QA, ensures that problems which occur on Shuttle (Orbiter) hardware are reported to the Projects Office and resolved in a timely and efficient manner. The PRACA review/signature process is a joint JSC/contractor process involving engineering at Rockwell and Engineering, SR&QA, and the Orbiter and GFE Projects Office at JSC. The Orbiter and GFE Projects Office identified the need to streamline the PRACA system. Program review teams (PRT's) made up of personnel from the involved organizations were established to identify ways to improve the PRACA process. The goal of the PRT's is to reduce the number of open problems by 30 percent by the end of fiscal year 1991.

Benefits Achieved:

In the SR&QA effort, more than 35 teams have been formed. They are addressing a variety of processes, e.g. review of specifications to meet operations and maintenance requirements specifications, pre-launch assessment review procedures, and change request evaluation and processing. A number of significant improvements have been made, e.g., a loop was removed from the change request (CR) evaluation process, resulting in a significant reduction in late CR's.

SLSD divisions have developed of work processes flow diagrams, identifying problems and areas for improvement. The Medical Sciences Division staff is working with Krug on improving work activities; the Man-Systems Division is addressing the job order process with GE; the Life Sciences Project and Solar Systems Exploration Divisions are addressing job order processes with LESC.

Improvements being implemented by the joint Facility Development Division/Brown and Root effort are providing more complete and accurate design products while reducing JSC review requirements, design cost, and turnaround time.

The SLSD Human Factors Group has grown from a handful of individual researchers, very focused in their own disciplines, to a powerful human factors consultant team. The group's customers--Shuttle, Space Station, and Advanced Programs--are receiving more integrated and thorough products because the team's interdisciplinary analyses provides greater assurance that designs will avoid awkward crew interfaces.

Prior to the improvement effort, PRACA used a formal serial process for all actions. This required numerous iterations, even when a problem was a recurrent one for which the closure rationale had been previously accepted. To date, the PRT's have made two major improvements: first, serial review and signature has been eliminated, significantly reducing processing time; second, PRT's now have the option of using a "short corrective action report (CAR)" that requires less documentation to close repetitive problems or problems that do not require any corrective action. In addition, the team effort has improved working relations between JSC and Rockwell. Overall, PRT support of Shuttle launches is more efficient and the backlog of open problems is decreasing.

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Ralph Albion, Jr.
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CATEGORY: Focus on the Customer

39. CUSTOMER SATISFACTION FORM

Kennedy Space Center (KSC)

Description of the Activity:

To assist KSC contractor Boeing Aerospace Operations to clearly identify its customer's requirements, a form has been completed by the office supervisors or leads. The customers, usually a Technical Representative and one or more Technical Contacts, will be identified at the top of the form. For each customer, the satisfaction criteria, mandatory conditions to be met, and conditions to be avoided are defined. Actions the group must take to ensure meeting the customer's requirements are identified. Finally, (TQM team projects that are either in progress or planned against the satisfaction of each customer's requirements are defined. This form will be reevaluated periodically and updated when new customers are identified.

Benefits Achieved:

The Customer Satisfaction form resulted in the Boeing organization having closer communication with their customers and established a clearer understanding of their requirements in terms of measures such as performance, schedule, and cost. Each employee better understands what requirement he/she is working to satisfy and the criteria used for measuring success.

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CATEGORY: Focus on the Customer

40. QUALITY PERFORMANCE INDICATOR (QPI) WORKSHOPS

Kennedy Space Center (KSC)

Description of the Activity:

This workshop was developed in-house and designed to help work groups develop performance measures and to improve EG&G Florida, Inc.'s Total Quality Management (TQM) system. It is targeted for a supervisor and his/her direct reports and involves the team working through a structured improvement process together. The workshop was developed based on the following principles:

- 1) Every organization has customers; some of these customers are internal and some are external
- 2) All of our quality improvement efforts should be focused on continuously improving our performance in meeting customer requirements
- 3) Eventually, every organization will develop improvement goals based on specific customer needs and develop an objective means of measuring their performance relative to the goals
- 4) Performance measures will be instituted using a participative approach based on the belief that people will support that which they help create.

Benefits Achieved:

The benefits achieved from this workshop are many. It helps teams identify their suppliers and customers, both internal and external. It helps identify supplier and customer requirements, where the gaps are in meeting the requirements, and what the team's improvement focus should be to meet those requirements. The process goes one step further by helping the team develop indicators that will show that they are making progress toward meeting those requirements.

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CATEGORY: Focus on the Customer

41. DEVELOPMENT OF THE ADVANCED MOBILE CALIBRATION SYSTEM

Langley Research Center (LaRC)

Description of the Activity:

Langley's Instrument Research Division has operated a mobile system for calibrating laboratory instruments in the field. Known as FELICS, for Field Electronics and Laboratory Instrument Calibration System, the system reduces a research instrument's out-of-service time by bringing calibration standards and test equipment to the using worksite. Although, quite productive, the current design has accuracy and operational limitations. Based on experience with FELICS, an advanced automated (personal computer based) mobile calibration workstation has been designed to augment support to the Center's many wind tunnels and other research laboratories.

The upgraded design incorporates new, more rugged calibration standards, and will be able to service substantially more types of research instrumentation than FELICS. The Advance Mobile Calibration System will be able to perform high-accuracy calibrations of a wide variety of electronic test and measuring equipment such as digital multimeters, oscilloscopes, temperature measuring, and indicating devices, amplifiers, signal conditioners, and power supplies. Performance requirements for the new system have been established, system elements procured, operation of the advanced system (including calibration control, data acquisition, data reduction, and calibration data sheet output) can all be handled through user-configurable software supporting manual, semiautomatic, or fully automatic closed-loop calibrations.

Benefits Achieved:

Benefits achieved (or projected) include:

- 1) An ability to calibrate instruments on site with an accuracy approaching that achieved in calibration laboratories
- 2) A substantial increase in the types of instruments able to be serviced on site
- 3) Improved scheduling and reduced waiting time for Langley research facilities with the new (second) system, and
- 4) minimized instrument maintenance costs through the automated calibration system and procedures.

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CATEGORY: Focus on the Customer

42. MANAGEMENT OPERATIONS CUSTOMER FEEDBACK SURVEY

Langley Research Center (LaRC)

Description of the Activity:

The LaRC Management Operations (M.O.) Directorate recently initiated a team of employee representatives from each division to survey their customers. The purpose was to better understand their support needs and to recommend improvements.

The process included interviewing 116 randomly selected civil service employees plus all program directors and division chiefs. The team also reviewed customer usage of ongoing services and factored feedback from M.O. employees.

Benefits Achieved:

The response was extremely supportive of the effort which identified 11 major recommendations for improvement. Some of the recommendations have already been implemented, such as:

- 1) A Directorate User's Guide was developed showing who to contact, by function. Phone numbers and mail stops are included and the document will be issued as an attachment to the Center phone book for ready reference. A similar approach was used for providing information on "help desks".
- 2) An integrated automated system for processing time and attendance records and for initiating and tracking purchase requests is targeted for implementation in the near future. Other automated information systems for a variety of vital administrative functions are also being developed.
- 3) The hours of operation at a guard gate and for the Fitness Center have been expanded.

These positive changes, and many more currently under development, were made in response to the detailed customer survey. This emphasizes the Center's commitment to quality and enhanced customer services. The M.O. Directorate plans to continue employee feedback as improvements occur.

Contact for More Information:

Robert R. Moore
804-928-6072

CATEGORY: Focus on the Customer

43. CONSTRUCTION OF RESEARCH ANALYSIS CENTER EXPANSION

Lewis Research Center (LeRC)

Description of the Activity:

The Research Analysis Center (RAC) Expansion project is a \$9.8 million expansion to the RAC. The project included the addition of approximately 51,000 square feet of new area, including 11,000 square feet of computer operations area, 16,000 square feet of computer support area, 8,000 square feet of offices, 6,000 square feet of utility support area, and 9,000 square feet for circulation, stairs, elevators, etc. During both the engineering and construction phase of the project many unique and innovative approaches were implemented.

Benefits Achieved:

- 1) Provided a new main entry atrium to act as a hub for computer related activities, with all user functions next to the new main entry to allow quick and easy access
- 2) Provided flexibility/expandability in all computer support areas with raised computer flooring and demountable partitions
- 3) The entire RAC Expansion footprint was structurally designed so that it could be expanded by 2 additional floors
- 4) The second floor computer operations was designed with floor loading capability to support a Cray Computer
- 5) A dedicated cooling tower was constructed to eliminate the subordinate use of Cooling Tower 5 which had caused continual thermal cycling of the HVAC systems
- 6) All major mechanical systems were designed with back/up redundancy capabilities to prevent single point failures, and
- 7) Traffic and circulation was improved around the RAC building by increasing the distance between the West area and Loop roads. Additional parking areas were provided.

The key to the success of the project was innovative coordination of construction activities to minimize disruptions to the existing building. Unique scheduling tools including critical path method (CPM) schedules and bar charts were utilized. The entire project was accomplished within budget and three months ahead of schedule. No shutdowns were experienced to computer systems and there was minimal impact on existing building personnel.

Contact for More Information:

Dallas Lauderdale
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CATEGORY: Focus on the Customer

44. FISCAL YEAR 1989 REHABILITATION OF 10X10 SUPERSONIC WIND TUNNEL (SWT)

Lewis Research Center (LeRC)

Description of the Activity:

The Lewis 10x10 SWT is the only high-speed (greater than Mach 2.0) propulsion wind tunnel in the NASA inventory and is one of two such large facilities in the United States and the free world. It is one of NASA's Unitary Plan wind tunnels and is unique because it does not require an exhaust scoop for testing operating propulsion systems. The 10x10 SWT provides a means for developing and verifying new, previously unexplored technologies as an integral and critical component of several multi-agency programs. This project modernized the 10x10 SWT and included the rewinding of the 34 year old main and secondary 37,000 horsepower drive motors, replacement of drive motor controls, replacement of the wind tunnel control and monitoring equipment with a state-of-the-art distributed control system, rehabilitation of the air dryer facility gas piping and burners to bring them into compliance with current codes and standards, addition of a new secure calibration/checkout model area, changes to the existing calibration/checkout area to increase tunnel availability for testing, and rehabilitation of the wind tunnel control room.

Benefits Achieved:

The project will extend the operating life of the tunnel by another 30 to 40 years, will provide a tunnel drive system and operating controls that will significantly improve efficiency and will make the on-line tunnel operation more productive for such future testing as the National Aerospace Plane, high speed research, and super sonic through flow fan programs.

Contact for More information:

Gary Klann
216-433-5715

CATEGORY: Focus on the Customer

45. "LET'S TALK ENGINEERING" - AWARENESS PROGRAM

Lewis Research Center (LeRC)

Description of the Activity:

The Lewis Awareness Communications Activity Group sponsored a three hour panel discussion on "Let's Talk Engineering". The panelists were the Director of Engineering and his senior management staff. The purpose of the panel discussion was to encourage the exchange of information between managers of the Engineering Directorate and the center research and development (R&D) staff on the functions of the Engineering Directorate (ED). The panel provided a fundamental understanding of what the Engineering Directorate is, what they do, and how they function at Lewis. Each person in the audience was given an opportunity to ask questions and raise concerns with the panel. Many questions revolved around the issue of the composite rate costs (see attachment B). Because of the particular interest in the composite rate topic, the ED management later sent a memorandum to each supervisor at Lewis to explain, and hopefully clarify, the issues involved.

Benefits Achieved:

The internal customers were able to increase their knowledge and understanding of Engineering Directorate functions. The panel discussion helped to dispel many misconceptions about the Engineering Directorate, and should enable the customer to make better use of the Directorate's services.

The Engineering Directorate management gained a better understanding of the concerns of the customers and increased their insight on issues important to them. The ED has since taken several actions to address the concerns raised by these questions. Specifically, because the customer better understood how the composite rate was calculated, what was included and excluded, and how it is applied to their projects, the number of misunderstandings over the topic have decreased and there is an improved feeling of teamwork between the ED staff and its internal customers.

Contact for More Information:

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CATEGORY: Focus on the Customer

46. LEWIS AEROSPACE TECHNOLOGY TO BENEFIT ORTHOPEDIC IMPLANT PERFORMANCE - ARTIFICIAL KNEE JOINT

Lewis Research Center (LeRC)

Description of the Activity:

Researchers from the Structures Division are working with medical specialists from Case Western Reserve University (CWRU) to improve the performance of artificial knee joints. The main purpose of the project is to transfer technology needed for orthopedic implants. The NASA researchers have the job of demonstrating that, with modifications, computer codes developed for aerospace use could be used to design a pilot model for a better artificial knee joint. CWRU will be able to take the pilot model and further develop it to the point that commercial manufacturers of knee joints can use it easily.

The computer codes being modified for orthopedic applications were originally developed to improve the propellers for the new aircraft. Much like the bone and tissue surrounding a knee joint, the propeller has a spar enclosed by a shell. Researchers working on the propeller codes realized the similarity and were ready three years ago when the Technology Utilization Office asked them for ideas that could be transferred to applications outside the aerospace arena. Full-time work at modifying the computer codes has been going on for a year.

Although in principle the human knee and an aircraft propeller may be similar, both the shape of the joint and the choice of materials compatible to the human system had to be taken into account when the codes were modified.

Benefits Achieved:

In the future, the codes will not only tell researchers what the optimum shape for the implant should be, but also which materials will be the least likely to be rejected by the human body. The use of the computer codes in the production of the artificial joints will allow for a near custom fit. This, in turn, will increase the life of the joint and reduce discomfort to the patient.

The LeRC team is working on ways to use the codes to produce implants with a stress distribution as near as possible to the natural state. Using the computer codes, doctors will be able to fit the implant to the patient rather than vice versa. The result will be a long-lasting joint that allows greater mobility and comfort to the patient.

The research may not end with the knee joint, however. The Technology Utilization Office may also be interested in discovering how this computer code could be applied to other joints for prosthesis replacement, such as in the hip, ankle, elbow, shoulder, and fingers.

Contact for More Information:

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CATEGORY: Focus on the Customer

47. AUTOMATED CALCULATION OF DUE DATES (ACDD)

Marshall Space Flight Center (MSFC)

Description of the Activity:

Automated Calculation of Due Dates (ACDD) provides an on-line method of calculating due dates for commercial invoices and vouchers received for payment, against purchase orders and contracts in the Financial Management Office (FMO) at MSFC. This system is an enhancement of the existing MSFC Accounting and Resources Tracking System (MARTS) implemented in 1988. The ACDD is an on-line application that establishes the payment due date for an invoice and records resulting disbursement transaction into the MARTS. This is accomplished by programming the terms and conditions set forth in the Prompt Payment Act and the NASA Cash Management Policies into a NATURAL software program that establishes a 30-day payment date based on the programs comparison of the invoice received date to the material/service received date. This system utilizes all contract and invoice terms and conditions housed in the MARTS. The system was implemented during the period November 1989 through February 1990.

Benefits Achieved:

Aside from reducing the amount of time it takes FMO to process a payment, the system automatically calculates and records discounts earned, plus adds on transportation charges and interest. It has allowed the FMO to discontinue maintaining most manual partial payment records and to establish warehousing of payments. In addition, overtime has been virtually eliminated and the number of accounting technicians needed for processing payments has been reduced. An estimated cost savings of \$78,000 annually will result from this process improvement.

Contact for More Information:

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CATEGORY: Focus on the Customer

48. OFF-THE-SHELF TRAINING PURCHASE ORDER

Marshall Space Flight Center (MSFC)

Description of the Activity:

In February 1989, a task team was appointed to develop a streamlined system for direct purchases of off-the-shelf training courses. The MSFC's annual training budget exceeds more than \$2 million a year with about 90 percent falling into the off-the-shelf category. A system was devised which included required documentation, forms, procedures, and management instructions which delegated authority for the approval of training orders to the appropriate management level. This provided for both vulnerability assessment and internal audit.

Benefits Achieved:

The benefits of the training procurement streamlining include consolidating within the Training Branch the responsibility for identification, scheduling, acquisition, and performance certification of off-the-shelf training courses. It eliminates the internal processing of a procurement request from training to the Procurement Office, thus reducing the time from identification of need to placement of the order. This provides for a more efficient utilization of personnel. It significantly reduces paperwork by replacing three existing forms with one document that serves as a procurement request, a purchase order, and a certification of performance.

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CATEGORY: Focus on the Customer

49. PROCUREMENT STREAMLINING

Marshall Space Flight Center (MSFC)

Description of the Activity:

Increased operational efficiency has resulted from improvements in two procurement areas.

In the first area, the MSFC has implemented a series of initiatives which expand the use of Source Evaluation Committees (SECs) and streamline the SEC process. The initiatives include:

- 1) Receiving waivers from Headquarters to use SEC instead of Source Evaluation Board (SEB) procedures on selected procurement over \$25 million which are not complex or involve recompetition of a service contract
- 2) Delegation by the Center Director for the Procurement Officer to function in the role of Source Selection Officer on the majority of these procurements
- 3) Development of a standard evaluation plan for use by all SECs in the evaluation of proposals
- 4) Development of standardized briefing charts for use by the SEC to provide more meaningful information to the Source Selection Official and to provide a consistent format for future SECs
- 5) Reduced documentation for SECs
- 6) Clearer instructions and a better understanding by the SEC of its mission using a detailed briefing made to the SEC before any activities begin, and a newly published SEB/SEC guidebook to provide detailed procedures, guidelines and samples for the SEB/SEC to follow, and
- 7) Sharing of lessons learned by all SEC Chairpersons.

In another area, several initiatives were implemented to streamline the approval of pre-renegotiation positions.

The first initiative enabled the Center Director to delegate approval authority to the Procurement Officer. After Headquarters delegations are received, the Procurement Officer submits a "Master Prenegotiation Approval List" to the Center Director for him to indicate which actions are to be delegated to the Procurement Officer. The Procurement Officer will subsequently provide the Center Director with feedback which compares the results of the negotiated agreements to the pre-negotiation approval levels.

The second initiative was to shorten the review period for prenegotiation positions which the Center Director is to approve. Prenegotiation positions were previously reviewed "serially"; that is, it proceeds through a review cycle one step at a time until all those who must review and approve it have done so. Instead of a serial review, a new process was implemented to allow for "parallel" review of the documents. A copy of the document is sent to each office for review a few days before the scheduled presentation to the Center Director. If significant concerns are raised, a pre-meeting is scheduled; otherwise, the meeting will take place and all parties will sign the document at the conclusion of the presentation.

The third initiative involves prenegotiation positions on procurement involving a formal SEB or SEC. Previously, prenegotiation positions were prepared after contractor selection was made. However, a new approach was instituted to incorporate the prenegotiation position approval into the SEB/SEC presentation. This approach provides for a short memo to reference reports, and other documentation such as cost analyses, already prepared as part of the SEB/SEC process. Only a small amount of other mandatory information required by the Federal Acquisition Regulations is included, such as the fee/profit discussion or other items which have a bearing on the negotiation. When the Source Selection Official makes a selection, he also signs the memo approving the prenegotiation position.

Benefits Achieved:

All seven initiatives related to streamlining the SEC process have provided substantial savings in the time required to complete the activity. The expanded use of SECs and the delegation of authority, when combined with the new streamlined process, allow for more efficient use of time. SECs are now given clearer directions and better understand what is expected for successful completion. Many of the required documents are already provided so as to eliminate the guessing or stress that comes with generating unfamiliar documentation.

These initiatives also enable contracts to be awarded earlier and can result in significant monetary savings to the Government when critical services or delivery schedules are involved. By delegating the Source Selection Official, several key managers no longer are required to devote time to this process. Also, the remaining people involved in the SEC process spend less time on these tasks, which in turn provides more productive use of their time. It also eliminates the preparation and review of unnecessary paperwork.

All three initiatives designed to streamline prenegotiation position approvals have provided considerable savings in the time taken to award a contract or modification. Contract negotiations cannot begin until the prenegotiation position is approved; therefore, these initiatives allow negotiations and actual work by the contractor to begin earlier. Significant monetary savings to the Government can result when delivery schedules are critical. The initiatives allow faster definition of unilateral contract actions which will reduce the amount of time the contractor will be performing work without any agreement on price. Less time spent by individuals on these tasks in the procurement cycle should result in increased employee productivity. Finally, the preparation and review of unnecessary paperwork is eliminated.

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CATEGORY: Focus on the Customer

50. SHORTENED FINAL SOFTWARE CYCLE FOR INTERNAL UPPER STAGE (IUS) PROGRAM

Marshall Space Flight Center (MSFC)

Description of the Activity:

The preparation of the final software to support and fly the IUS for any mission has, in the past, required 120 days lead time for completion and required a large staff of highly knowledgeable trajectory analysts and computer programmers to develop, implement, and maintain. The software developed also had a finite period of application (usually 60 days) after which it required rework. The rework usually took the form of another data load good for another 60 days. To shorten this lead time and reduce the overall man-hour cost to the IUS Program, an effort was initiated to reduce the number of variables that had to be considered and implemented in the software and to reduce the operations needed to service the software for a given mission.

First, a concerted effort was made to fully understand the variability associated with any mission class and to assess the effect of this variability on the final mission. In cases where the range of variation had minimal impact on the IUS operation, the variable was reduced to a mean value and entered in software as a constant. Second, process changes were made to enable the use of the remaining variables in the flight software as operational modules which could be activated as necessary in response to launch and flight parameters. Changes could then be implemented by inserting a minimum set of variables. The on-board software would be capable of completing the task. Finally, the life of the software mission data load was increased. With the understanding gained in the two aforementioned efforts, in addition to restructuring the software, it is now possible to have a single mission data load on the IUS that will fly a specific mission class at any time throughout a full year without modification beyond the initial vehicle parameters.

Benefits Achieved:

The IUS final software cycle has been reduced from 120 days to 76 days, and has the potential to be reduced to as low as 44 days. The manpower to support the reduced final cycle has decreased significantly, and the off-the-shelf availability of a mission data load for specific mission classes has significantly reduced the level of in-depth knowledge necessary to implement its use. Finally, the shelf life of the mission data loads has been increased from 60 days to at least a year so that manifest changes and delays in launch create no software issues.

Contact for More Information:

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CATEGORY: Focus on the Customer

51. SOLID ROCKET BOOSTER (SRB) LAUNCH FLOW REQUIREMENTS

Marshall Space Flight Center (MSFC)

Description of the Activity:

The SRB Project Office and USBI Company, Inc. have worked closely with the KSC to implement several launch flow enhancements. These enhancements are intended to reduce SRB processing time at KSC by simplifying hardware installation and close-outs as well as improving the quality of the work. A prime example of this effort has been in the area of the aft attach strut and external tank attach (ETA) ring close-outs, which are generally considered to be part of the critical path. Additionally, development test programs were started to incorporate a premixed frozen and premolded RTV 3-6077 for performing close-outs behind the aft struts.

Benefits Achieved:

The launch flow enhancements implemented to date have saved 104 schedule hours and 6 serial hours per flight set of SRB hardware processed at the KSC. Those to be implemented in the future will save an additional 66 schedule and 18 serial hours. Additionally, increased reliability and quality is realized from simplification of the strut and ETA ring close-outs. An added benefit has been the high spirit of cooperation this program has fostered between the MSFC and the KSC and their contractors in working towards a common goal directly related to the enhancement of the Space Shuttle Program.

Contact for More Information:

M. G. Feathers
205-721-2616

CATEGORY: Focus on the Customer

52. SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM

NASA Headquarters (Code C)

Description of the Activity:

Since its inception, the NASA SBIR Program has been of benefit to both NASA and the high technology small business community. By making it possible for more small businesses to participate in NASA's research and development, SBIR also provides opportunities for these entrepreneurs to develop products which may have significant commercial markets and a positive impact on our economy. By submitting a proposal, and especially by winning an SBIR contract, the capabilities of a business becomes known to NASA and its contractors. The phased structure of SBIR makes it ideal to try out new ideas without risking a lot of resources. SBIR can be used to leverage a company's Research & Development (R&D) resources in creating or adding to a product line.

On November 27-28, 1990, NASA's first Technology 2000 Conference and Exposition was held in Washington, DC. The purpose of this conference was to showcase high technology and its commercial applications. The conference was attended by over 2,400 persons, 80 percent of whom were from industry. To respond to NASA's SBIR constituency and customer base, the SBIR Office published a catalog in which 61 companies, out of 250 contacted, provided information on 88 products that directly resulted from SBIR contract awards. Its intent was to stimulate the interest of potential customers and markets for the products listed and encourage contacts with the small firms whose research results have already borne fruit. Plans are to continually update the catalog to include additional products as they develop. Although this catalog only contains a partial list of SBIR projects that have phased into commercial applications, it is an indicator of success for the program. The continual review and update of the catalog against its current benchmark will allow NASA to measure SBIR commercial accomplishments.

Benefits Achieved:

By focusing on the needs of the customer, the SBIR Program is stimulating creativity, innovation, and new technology development. By measuring the commercial success of products resulting from the SBIR contract awards, NASA can realize that its investment in SBIR is not only paying off for NASA, but is also helping the U.S. economy by introducing new products and services.

Contact for More Information:

Harry Johnson
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CATEGORY: Focus on the Customer

**53. GENERAL SERVICES ADMINISTRATION (GSA) DELEGATION OF
AUTHORITY TO NASA FOR CONSTRUCTION PROJECTS**

NASA Headquarters (Code DBC)

Description of the Activity:

NASA has been given the authority to go directly to the term construction to accomplish construction up to \$10,000 in NASA leased space which is controlled by GSA.

Benefits Achieved:

An estimated 20 days are gained by removing GSA from the construction cycle. Cost savings per project is approximately 12 percent. Five projects have been completed from October 1989 to September 1990 and the cost savings is \$2,077. An added benefit is a more efficient response time for the space user.

Contact for More Information:

Willie Bullock
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CATEGORY: Focus on the Customer

54. LOGISTICS MANAGEMENT BRANCH ESTABLISHED SEVERAL NEW PROGRAMS FOR HEADQUARTERS FOCUSING ON CUSTOMER SERVICE

NASA Headquarters (Code DBE)

Description of the Activity:

In 1990 the Logistics Management Branch made significant improvements in the level of customer service at Headquarters. These improvements included: opening a Supply Service Center (SSC), opening Headquarter's first Excess Holding Facility (EHF), obtaining 50 additional parking spaces for Headquarters carpools, developing monthly Small Purchases Status Reports (SPSR), developing internal operating procedures (IOP) & automated system documentation for all logistics activities, leasing 6,000 square feet of warehouse space, instituting the Government Credit Card System (GCCS) at Headquarters, instituting shuttle bus service between Headquarters and Crystal City, Virginia locations, developing automated parking management, passport and visa tracking systems, and initiating the use of rehabilitated laser printer cartridges and rehabilitated furniture from the General Services Administration.

Benefits Achieved:

The SSC provides Headquarters customers with frequently used supplies without having to wait the 2 to 4 weeks required for off-site deliveries. The EHF permits NASA to reduce losses and alleviate overcrowded and unsafe conditions in offices and halls. The 50 additional parking spaces enables improved quality of life for Headquarter personnel. The SPSR's provides codes with up-to-date status on all procurement actions under \$10,000. Our documented IOP's help improve employee training and provide increased support to customers. The leased warehouse provides improved customer response time, consolidates all of Headquarters storage activities and decreases vulnerability. The use of the GCCS decreased procurement and delivery time by 4 to 6 weeks. The expanded shuttle bus service decreased customers meeting travel time and improved quality of work life. The automated parking, passport, and visa programs now provide up-to-date information, improve customer's response time and facilitate carpooling. The use of rehabilitated laser printer cartridges and furniture has saved about \$30,000 in fiscal year 1990.

Contact for More Information:

Christine Williams
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CATEGORY: Focus on the Customer

55. IMPROVEMENT AND FACILITATION OF COMMUNICATION WITH CLIENT PROGRAM OFFICES

NASA Headquarters (Code HW)

Description of the Activity:

Creation, publication, and distribution of procurement technical guides written for use by the program offices and a monthly procurement newsletter directed towards contractors and the program offices.

The technical guides provide specific, step by step guidance on the procurement process written in straight forward terms for non-procurement personnel. These guides include, but are not limited to: the PR Initiator's Guide, the NASA Headquarters Guide for Contracting Officer's Technical Representatives, and the Guide to the Acquisition Process for Grants.

The monthly "Acquisition Roundtable" newsletter, published by the division, addresses pertinent issues and advises program offices of upcoming training opportunities, procurement deadlines, and personnel changes on a regular basis.

Benefits Achieved:

- 1) Improved understanding of a complex subject by the program offices
- 2) Improved relations with the program offices and potential/actual contractors at NASA
- 3) Regular and timely communication of problems and/or other information which could impact the procurement process to all program offices at NASA Headquarters via the newsletter. This keeps the program offices abreast of personnel changes, policy changes, and new procedures which, in turn, leads to a reduction in the "I never heard of that" and "who is handling my procurement now" syndrome, and
- 4) When the newsletter was originally published it had an external publication list of approximately 147. With only its sixth issue (now in production) the mailing list - has expanded to 180, due to requested demand.

Contact for More Information:

Dennis Douvarjo
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CATEGORY: Focus on the Customer

**56. TECHNICAL AND MANAGEMENT INFORMATION SYSTEM (TMIS) SUPPORT
FOR THE INTERNAL SYSTEM PRELIMINARY DESIGN REVIEW (ISPDR)**

NASA Headquarters (Code MSO-1)

Description of the Activity:

Acknowledged as crucial to the success of ISPDR, the Space Station Freedom Project Office (SSFPO) TMIS project spared no effort in ensuring that customer support was of the highest quality. In the months preceding ISPDR, TMIS reorganized for the total dedication of available resources to developing and polishing the applications, networks, mainframe environments and support structure that would ensure that the expected thousands of Review Item Discrepancies (RID's) would be processed smoothly and expeditiously.

To reduce travel requirements and speed coordination, TMIS upgraded system capacity and provided remote printing capability. NASA and Boeing Computer Services, the TMIS Integration Contractor, worked closely with ISPDR management to refine the automated systems that would support the RID initiation, submission, processing, and dispositioning process. The Automated RID Tracking System (ARTS) is one result of that effort, and was the primary tool used to process and track all RID activity for ISPDR and many of the Preliminary Design Reviews (PDR's) conducted earlier at the NASA Centers.

To maximize Civil Servant productivity, TMIS provided "power users" to directly support the use of ARTS by 400 participants in 14 review teams. This concept and ARTS worked exceptionally well, enabling the teams to process over 9,000 RID's from initiation through disposition within the aggressive ISPDR schedule. This focus on the customer's needs paid big dividends in terms of schedule accomplishment, accuracy, and productivity.

Benefits Achieved:

- 1) Initiated, submitted, processed, evaluated, dispositioned, implemented and tracked over 9,000 RID's within six weeks of ISPDR
- 2) Minimized travel and extended temporary duty through the use of data communication networks and video teleconferencing, and
- 3) Effectively facilitated the integration of review input from all NASA components as well as international partners.

Contact for More Information:

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CATEGORY: Focus on the Customer

**57. "QUALITY AND PRODUCTIVITY AWARENESS" NEWSLETTER SERVES AS
VEHICLE FOR TOTAL QUALITY MANAGEMENT (TQM) INFORMATION
EXCHANGE AND EMPLOYEE AND TEAM RECOGNITION**

NASA Headquarters (Code QB)

Description of the Activity:

In its third year of publication, "Quality and Productivity Awareness," a quarterly newsletter compiled by the NASA Office of Safety and Mission Quality, NASA Quality and Productivity Improvement Programs Division, has continued to inform its readers on current activities and improvements taking place throughout the NASA/contractor community in the area of TQM. This newsletter incorporates submissions from the NASA field installations, Headquarters, and contractor organizations as a vehicle for mass dissemination of quality and productivity information and includes feature articles on major quality and productivity events, including the annual NASA/Contractors Conference, the George M. Low Trophy: NASA's Quality and Excellence Award, and annual Quality Month Activities taking place throughout NASA. It also serves as a vehicle for NASA's Employee Involvement Teams to publicize their accomplishments.

Benefits Achieved:

This newsletter, with a circulation of more than 20,000, provides the NASA/contractor community with information on activities and accomplishments in TQM and provides points of contact for readers interested in learning more about the activities highlighted. It also provides a tool for team recognition for improvement activities. The wide distribution allows for readership and visibility of TQM initiatives at each NASA Center, Headquarters, and approximately 2,300 individuals at contractor sites.

Contact for More Information:

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CATEGORY: Focus on the Customer

58. TOTAL QUALITY MANAGEMENT (TQM) COLLOQUIA

NASA Headquarters (Code QB)

Description of the Activity:

The NASA Office of Safety and Mission Quality, NASA Quality and Productivity Improvement Programs Division has initiated a series of bimonthly TQM Colloquia, held at NASA installations and broadcast live over NASA Select. These seminars are designed to interest and educate NASA and its contractors on the elements and strategies of TQM and its implementation. Presentations have been given by several prominent quality and productivity leaders from government, private industry, and non-profit organizations. The typical colloquium runs for one to two hours and includes a question and answer session.

Benefits Achieved:

The TQM Colloquia provides all NASA personnel and contractors with an opportunity, on a regular basis, to increase awareness of, and knowledge about, TQM principles and implementation techniques from experts in the field. The question and answer sessions permit the presenters and audience to focus on, and find solutions to, specific NASA TQM implementation concerns. The TQM Colloquia have become an important element in Code Q's focus on NASA employees as customers.

Contact for More Information:

Eric C. Raynor
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CATEGORY: Focus on the Customer

59. DEVELOPMENT OF A SMALL SUPPLIER QUALITY ASSURANCE ASSISTANCE PROGRAM (SSQAAP)

NASA Headquarters (Code QR)

Description of the Activity:

NASA Headquarters, Code Q has developed Small Supplier Quality Assurance Assistance Program (SSQAAP) to assist small and disadvantaged businesses (S/DB) who want to do business with NASA. It has been recognized that often S/DBs are not prepared to meet the quality requirements imposed by NASA.

In order to assist S/DBs, Code QR developed a voluntary training program employing a user friendly computer program. The computer program requires the prospective supplier to fill out a questionnaire which includes information on business, history, and in-house quality/inspection requirements. The completed questionnaire disk is submitted to NASA/Contractor for use in ascertaining what the supplier needs and arrangements are made to assist the supplier as appropriate.

The SSQAAP is now only a NASA/Contractor effort, however Code QR has discussed with representatives from the Small Business Administration (SBA) its use nation-wide. Currently SBA has included reference to the SSQAAP in the SBA Procurement Automated Source System.

Benefits Achieved:

The SSQAAP provides an easy method for S/DBs to communicate with NASA/Contractors their interest in doing business with NASA. The program permits the exchange of vital information and little cost to the supplier. It also provides a current list of what S/DA businesses by commodity and capability are available and interested in government business. In addition the questionnaire provides NASA/Contractor what short falls the supplier has in its quality/inspection system and where help may be needed.

Contact for More Information:

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CATEGORY: Focus On The Customer

60. ESTABLISHMENT OF A GOVERNMENT INTERAGENCY WORKING GROUP (IAWG)

NASA Headquarters (Code QR)

Description of Activity:

NASA Headquarters, Code Q in conjunction with Nuclear Regulatory Commission (NRC) has initiated a Government Interagency Working Group (IAWG) to expedite the exchange of sensitive information relating to problem parts and suppliers (e.g. counterfeit, fraudulent and nonconforming parts and material). The requirement for such an interchange was recognized by Code QR and promptly initiated with the cooperation of the Government Agencies experiencing similar problems with suppliers and nonconforming parts and materials.

The IAWG is chaired by NASA Code Q and consists of representatives from both the investigative and technical offices within NASA, NRC, NIST, DoT, FAA, DoE, DoD and the Military Services and GSA. The group meets generally on a quarterly basis unless otherwise required to meet more frequently due to serious issues which must be discussed or information exchanged.

Benefits Achieved:

The IAWG provides a rapid method for exchanging sensitive information among government agencies ensuring not only that problem suppliers and material identified by one agency are disclosed to all others within the group but that action be taken to prevent other agencies from experiencing the same problems.

Several actions are now ongoing which will greatly enhance the effectiveness of the communications network initiated by the IAWG. First, the membership of the Government Industry Data Exchange Program, which is being used by the IAWG for transmission of sensitive information via electronic mail, is being expanded to all Government agencies by the Office of Management and Budget policy letter. Second, the IAWG will become an official entity by becoming a subcommittee under the GIDEP Government Advisory Group.

Contact for More Information:

Aldo Domenichini, Jr.
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CATEGORY: Focus on the Customer

61. INCREASED CUSTOMER FOCUS BY STENNIS CONTRACTORS

Stennis Space Center (SSC)

Description of the Activity:

All Sverdrup Technology, Inc. Directors, Managers, and Supervisors have contacted their external customers to ensure a common understanding of requirements and to receive feedback from customers on the quality of work. This effort is continuing on an annual basis with quarterly checkups by the General Manager.

Benefits Achieved:

Our organization has achieved a better understanding of job requirements and customer expectations. We have also found some areas of needed improvement and have established a better rapport with customers.

Contact for More Information:

Dan Kelley
601-688-3678

CATEGORY: Focus on the Customer

**62. TEACHERS RESOURCES EMPLOYEE ACTION CIRCLE PLANS HANDS-ON
PARTICIPATORY LEARNING CENTER FOR CHILDREN**

Stennis Space Center (SSC)

Description of the Activity:

World Services' Teachers Resource Center hosted 3,307 teachers from Mississippi, Louisiana, and Alabama in workshops this year. The program is designed to capture and maintain student interest in science and mathematics at an early age. The workshops are designed to upgrade the knowledge, skills, and experience of teachers and university faculty. Stennis is developing a hands-on participatory learning center which will focus on students and offer them exhibits on their educational and motivational level. Our "Space Believe" museum will be partially operational in fiscal year 1991.

Benefits Achieved:

The mission of our Teachers Resources Employee Action Circle has been to teach basic science to the young people of our region in an effort to enrich classroom science, enhance thinking skills, and motivate future generations to pursue careers in engineering, science, and technology. This mission is compatible with NASA's education goals and priorities at Stennis Space Center.

Project "Space Believe" is a greatly needed facility with a tremendous potential to serve the educational community. To demonstrate the widespread interest "Space Believe" has generated, SSC has received many letters of support from congressional, educational, and community leaders on this project.

Contact for More Information:

John Lovitt
601-688-2348

EMPLOYEE TRAINING AND RECOGNITION

CATEGORY: Employee Training and Recognition

63. ACCELERATED TQM START-UP AT THE UNISYS CORPORATION/GODDARD SPACE FLIGHT CENTER CONTRACT

Goddard Space Flight Center (GSFC)

Description of the Activity:

Unisys Corporation management is committed to establishing a Total Quality Management (TQM) methodology for improving service to the GSFC. To accomplish this goal, an accelerated implementation plan was developed. The first stage of this plan is the establishment of a management team to provide direction, management training and employee training.

A management team of six lead supervisors representing all Unisys groups on the GSFC contract was established. This group, titled the Quality/Productivity Improvement Team (QPIT), is responsible for the implementation of TQM and to ensure that adequate tools are available for problem correction, training is sufficient, and employees are recognized for their accomplishments.

Training started with the Project Manager and the Deputy Project Manager. This training consisted of three days and four days respectively of course work at a leading TQM training facility. Subsequently, the Deputy Project Manager and a Lead Supervisor received four days of training on how to present TQM to all employees.

An employee training program was developed and implemented by Unisys, and consists of a two hour introductory course that covers TQM philosophy, objectives, and language, and three workshops (of 3 hours each) within the department. The three workshops cover the following topics:

- 1) Establishing customer needs and expectations
- 2) Conducting Process Analysis, and
- 3) Performing Continuous Improvement

In the last six months, the following has been accomplished:

- 1) Management training has been completed
- 2) Over one-half the staff of 230 total employees have attended the two hour introductory course
- 3) Unisys QPIT designated
- 4) Unisys QPIT Charter completed
- 5) Unisys Corrective Action Teams (CAT) assigned
- 6) 1991 Facility Goals established, and
- 7) Contract Quality Policy developed

Benefits Achieved:

The benefits resulting from the TQM Training is as follows:

- 1) Many work processes have been documented and reviewed
- 2) Employees now recognize internal and external customers
- 3) A common quality mindset and language has begun to emerge
- 4) Several processes have been significantly upgraded
- 5) Process measurements have been developed using TQM
- 6) Concern over internal and external customer needs, expectations, and requirements has been expressed.

Contact for More Information:

John Schwabe
301-794-2702

CATEGORY: Employee Training and Recognition

64. KNOWLEDGE CAPTURE

Goddard Space Flight Center (GSFC)

Description of the Activity:

The Knowledge Capture Program was designed to tackle the long standing problem of how to capture, preserve and transfer critical knowledge and skills necessary to maintain the technical expertise and competency within the Engineering Directorate. The senior level staff formed a steering committee to identify the critical skill competencies that needed to be transferred. Mentors and mentees were identified by the first line supervisors to participate in the training.

The program is based on a unique team approach in which experts, younger employees, and line managers, aided by a trained facilitator, work in groups to determine the best methods with which to transfer the knowledge. The key elements of the Knowledge Capture training are:

- Identify competencies
- Determine the learning methodologies
- Develop teaching material
- Communication/Transfer
- Measure Results

There is a strong commitment by management to assure that this process continues. The on going nature of this process is placed with the first line supervisors who must maintain the process as part of their performance plans.

Benefits Achieved:

Specific technology and engineering competencies will be maintained and provide the Directorate with the skills necessary to continue running successful flight programs. This will ensure the competency level of the Directorate and enable the Directorate to continue producing an outstanding end product.

Contact for More Information:

James Robinson
301-286-8776

CATEGORY: Employee Training and Recognition

**65. PREPARATION OF PROJECT CONTROL HANDBOOKS FOR FLIGHT PROJECTS
DIRECTORATES USE**

Goddard Space Flight Center (GSFC)

Description of the Activity:

Conducted surveys of Project Control practices and methods throughout the Flight Projects Directorate. With the participation of project representatives, documented and evaluated Project Control practices. Prepared handbooks describing the more productive practices or the Directorate guidelines on Project Control methods in Work Breakdown Structures, schedule management, configuration management, management and information systems, library and documentation, and Monthly Status Review (MSR) Guidelines.

Benefits Achieved:

The more productive Project Control methods have been documented and are available for use in evaluating project activities, employee skill management, and new employee training.

Contact for More Information:

August H. Wessels
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CATEGORY: Employee Training and Recognition

66. PROJECT MANAGEMENT DEVELOPMENT EMPRISE (PMDE)

Goddard Space Flight Center (GSFC)

Description of the Activity:

The purpose is to design and implement a comprehensive training program for GS/GM 12-14 high potential candidates for an accelerated career development path leading to senior project management positions at the GSFC. Within the next 4 years an inordinate number of current senior project managers (including deputies and deputies for resources) will be eligible for retirement. An analysis of age and grade distribution within feeder organizations at GSFC shows a serious gap in normal candidate development evolution. This phenomena could result in a discontinuity of best qualified candidates for project management positions.

The objectives and features of PDME are as follows:

Objectives -

- 1) Minimize threat to continuity of professional management of GSFC flight projects
- 2) Identify high potential employees having leadership qualities and place them on accelerated (fast track) career development path
- 3) Establish, manage, and maintain a formalized, structured management development program
- 4) Provide selected candidates with the guidance, direction, training, and work experience to enable them to assume, with confidence, key flight project management positions, and
- 5) Target positions are senior level project management positions - technical and business management - in the FPD.

Program Features -

- 1) Selection process will be formal and rigorous
- 2) Entry level for program will generally be GS/GM-12 through 14
- 3) Participants will remain in current position during development training
- 4) Up to 25 percent of time will be spent in formal training and job assignments for a minimum of approximately 2 to 4 years
- 5) Final selection is made by Director of Flight Projects Directorate acting upon recommendations of an Advisory Board
- 6) A PDME Advisory Board will evaluate and recommend applicants for selection, develop training/work experiences, and monitor progress and performance
- 7) A mentor from among senior FPD managers will guide, counsel, and otherwise assist each "mentee"
- 8) Accelerated development will qualify mentees for positions of progressive responsibility and promotion through Grade 15 without further competition, and
- 9) Addendum to Position Descriptions and merit pay performance plan.

Benefits Achieved:

The first "class" of PMDE participants was selected during 1990. It consisted of eight applicants from an initial pool of 106 applications. Three selectees will be on the business management track targeting for Deputy Project Manager/Resources (GM-15) positions, and five selectees will be on the technical management track targeted for Deputy Project Manager and Project Manager (GM-15) positions. The 1990 statistical background is as follows:

1990 Competition Statistical Background -

Personnel screened out 7 of 106 PDME applications. Of the remaining 99, 55 were technical and 44 were administrative. The technical panel submitted 23 of 55 candidates to the Advisory Board for consideration. The administrative panel submitted 18 of 44 candidates to the Advisory Board. Technical grades included GS-12 (2), GS-13 (13), and GS-14 (5). Administrative grades included GS-12 (7), GS/GM-13 (6), and GM-14 (2). Within 9 months, four participants have been reassigned to positions of greater responsibility and two more are currently in the process of being advanced. The follow-on competition for the 1991 class commence with a formal announcement being posted on January 22, 1991.

The 1991 PMDE competition resulted in the selection of seven Mentees; 4 technical and 3 administrative. Of the 88 applications received in Personnel, 69 were technical and 19 administrative. The technical panel submitted 16 candidates and the administrative panel submitted 10 candidates to the Advisory Board for consideration. All 26 candidates were interviewed by the Advisory Board. Technical grades included GS-13 (8) and GS-14 (8). Administrative grades included GS-12 (5), GS-13 (3), and GM-14 (2). The annual PMDE competition will begin for the third group in January, 1992 and should result in the selection of a similar number of participants.

Contact for More Information:

Paul A. Mowatt
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CATEGORY: Employee Training and Recognition

67. TECHNICAL MANAGER TRAINING PROGRAM (TMTP)

Goddard Space Flight Center (GSFC)

Description of the Activity:

This program is held twice a year at the Management Education Center at Wallops Island, Virginia. The program is targeted for current and future technical project managers, as well as appropriate line management and staff. The objectives of the course are to provide information that will enable participants to plan, organize, implement, and control technical projects within the GSFC and NASA environment. This training emphasizes hands-on experience in techniques of project management. It includes a combination of lectures, exercises, and case studies. Lecturers include GSFC project managers and speakers from private industry who discuss the elements important to "good" project management.

Benefits Achieved:

The Engineering Directorate is already experiencing positive benefits from the application of these principles on the job by increased effectiveness in project management skills by the participant.

Contact for More Information:

Carolyn Casey
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CATEGORY: Employee Training and Recognition

68. QUALITY AND PRODUCTIVITY MONTH ACTIVITIES

Jet Propulsion Laboratory (JPL)

Description of the Activity:

Celebrating National Quality Month, more than 400 JPL personnel were honored with certificates at a Quality and Productivity Recognition Breakfast. Specifically acknowledged were members of the JPL Enhancements Teams (JETs) and others who contributed to the Laboratory's productivity endeavors. The program included a video excerpt of the NASA Administrator's message on National Quality Month and Captain Robert Crippen in "The Unwritten Contract", a Marshall Space Flight Center production.

Benefits Achieved:

Provided positive management feedback to employees by recognizing their individual and collective improvement efforts. Heightened teamwork awareness and the importance of each persons contributions.

Contact for More Information:

Mary Wong
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CATEGORY: Employee Training and Recognition

69. SECURITY TRAINING

Jet Propulsion Laboratory (JPL)

Description of the Activity:

A Traffic Control course, presented by an Administration of Justice instructor from Pasadena City College, was given to all JPL Plant Protection officers.

All JPL Plant Protection officers successfully completed the NASA approved Firearms Training course which includes: care, cleaning, firearms safety and qualification with assigned weapons.

Benefits Achieved:

The Traffic Control course helped standardize traffic control techniques at JPL, which enhanced traffic flow and eliminates driver doubt in officers' intentions.

Completion of the Firearms Training resulted in Plant Protection officers receiving certification and authority to carry unconcealed weapons to protect NASA owned property at JPL facilities.

Contact for More Information:

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CATEGORY: Employee Training and Recognition

70. VARIETY OF TRAINING ACTIVITIES SUPPORT TOTAL QUALITY AT THE JOHNSON SPACE CENTER

Johnson Space Center (JSC)

Description of the Activity:

A variety of training activities at the JSC during 1990 have contributed to increased quality awareness across the Center. These have included:

- 1) A four day off-site seminar by Dr. W. Edwards Deming at which attendees were exposed to Dr. Deming's unique and inspirational philosophies regarding quality management. Deming described personal experiences in applying his 14 points for management in Japanese and American industry. The seminar included daily working groups in which attendees discussed workplace issues and how Dr. Deming's 14 points might apply.
- 2) A half-day Total Quality Familiarization workshop to introduce Total Quality concepts and familiarize attendees with various supporting tools and techniques. The session has been presented primarily to JSC managers, but is also available to organizational groups that include all levels of employees. A session has also been held for representatives of the JSC/Contractor Team Excellence Forum.
- 3) Classes for civil service and contractor personnel in statistical process control (SPC) and related leadership skills, team skills, and process improvement skills.

Benefits Achieved:

More than 450 civil service and contractor personnel, primarily managers, attended the Deming seminars. For many, this was their first exposure to a Total Quality philosophy. Dr. Deming's explanation of variability and randomness, and his 14 points for management, gave them important insight into how a quality system should operate and stimulated new thinking on the definition of quality and how it can be achieved.

Nearly 350 JSC managers and employees have attended TQM Familiarization sessions. A common Total Quality understanding and vocabulary are being established. A number of follow-up activities have been initiated, and are aimed at in-depth analysis and improvement of organizational processes and procedures. A follow-on workshop on work process analysis has been developed to support these activities.

An introductory SPC course has been developed for all personnel at JSC. This course has been given to personnel in Safety, Reliability, and Quality Assurance (SR&QA) and in other directorates at JSC. This exposure to basic SPC principles has resulted in the use of SPC in various areas of the Center. For example, control charts to evaluate metal plating processes are being used in JSC's manufacturing facility, and SPC software provided to course attendees is being used in many of the Center's engineering disciplines.

Contact for More Information:

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713-483-9295

CATEGORY: Employee Training and Recognition

71. MORE EFFECTIVE APPRENTICESHIP TRAINING ASSIGNMENTS

Langley Research Center (LaRC)

Description of the Activity:

During the apprenticeship training period, electrical trainees are assigned to many different facilities on a six month rotational basis. The purpose of this rotational assignment is to provide the trainee with a broad background of learning in many of the research disciplines. When they graduate from the Apprentice Program they should have the background and skills necessary to become technicians capable of supporting any one of a number of special purpose research facilities.

One of the pitfalls in this learning process occurs when the facilities to which trainees are assigned are undergoing concentrated efforts such as a rehabilitation or a specific test which may require total dedication from the support team. In these instances our apprentices may miss out on the opportunity to learn many other important features of the facility or the fundamentals of specific components or equipment.

In an effort to alleviate this problem, we have instituted a new program where the apprentice is given a list of experience goals and objectives for the facility in which he or she is assigned. The apprentice is also told by their supervisor that, during and at the end of the assignment, they will be questioned as to what learning accomplishments have been achieved.

Benefits Achieved:

The benefit anticipated from this new program is the creation of a much more consistent and broader base of knowledge and experience for the apprentices in each rotational assignment. The list of goals and objectives will enhance the learning process in each facility regardless of the workload at the time of the assignment. This increased knowledge and experience will ultimately enhance the Operations Support Division's technical capability, and should result in better service to the research community at the Center.

Contact for More Information:

Charles M. Southall, III
804-928-4577

CATEGORY: Employee Training and Recognition

72. DECREASED TECHNOLOGY TEST BED TURNAROUND TIME

Marshall Space Flight Center (MSFC)

Description of the Activity:

The Space Shuttle Main Engine (SSME) is a complex engine utilizing a staged combustion cycle for maximum performance. The staged combustion cycle burns the fuel in a fuel and oxidizer preburner, at very low oxidizer/fuel (O/F) ratios, and the combustion products are used to drive the high pressure propellant turbopumps. After powering the turbopumps, the combustion products flow to the main combustion chamber (MCC) where additional oxidizer is mixed and the mixture is burned again to provide thrust. Of all engine cycles, the staged combustion cycle has the most complex start and shutdown sequences and the most complex control logic. The Technology Test Bed (TTB) Program was developed to further characterize the SSME and to test advanced technology candidates for possible SSME development.

During the early phases of the TTB test program, fifteen to twenty days were required to perform post-test inspections, review the test data, conduct data reviews and prepare for the next TTB test. To decrease this turn-around time, the concurrent engineering principles of TQM were applied to those tasks requiring completion between the end of one test and the initiation of the subsequent test to reduce that fifteen or twenty days to six days. This Cross Functional Product Development Team (PDT) exercise was performed by three of MSFC's younger engineers, two from the Propulsion Laboratory and one from the Safety and Mission Assurance Office. Since implementing the results, the three engineers have briefed MSFC management on the methodology used to arrive at the final study results, and the procedures to decrease the time between tests.

Benefits Achieved:

As a result of this PDT, TTB tests can be conducted by a factor of 2 1/2 to 3 times faster than the original rate. This acceleration of the test rate has resulted in decreased total manpower costs and, consequently, program costs.

Contact for More Information:

M. R. Ise
205-544-4946

CATEGORY: Employee Training and Recognition

**73. TOTAL QUALITY MANAGEMENT (TQM) TRAINING AT MARSHALL SPACE
FLIGHT CENTER**

Marshall Space Flight Center (MSFC)

Description of the Activity:

The MSFC fully supports Total Quality Management and is dedicated to providing the leadership and long-term commitment necessary to establish a Centerwide climate which fosters continuous quality and productivity improvements.

To date, MSFC has participated in a wide-range of TQM related training and educational activities. This includes attendance by over 350 MSFC managers at George Butts' TQM presentation. Over 60 employees have received an extensive 32-hour training course given by the American Supplier Institute (ASI). This training detailed the use of such tools as Quality Function Deployment, The House of Quality, Concurrent Engineering, and Statistical Process Control. Other courses have included a TQM overview by Advanced Technology, Inc. (25 in attendance), various Deming seminars (24 in attendance), an overview by Philip Crosby, a TQM perspective by Toru Iura, participation in the General Loh and all subsequent NASA TQM Colloquia, and attendance at various TQM seminars and conferences sponsored by NASA and other government agencies. Mr. Jim Weathersbee, a Navy employee assigned to the Federal Quality Institute (FQI), at a presentation to the MSFC Productivity Steering Council, reviewed the services offered by the FQI in educating employees in TQM. Dr. John Lovette of the University of Alabama in Huntsville's Industrial Systems Engineering Department briefed the Council on the TQM activities being done by UAH in conjunction with the Army Missile Command. All of these activities are in addition to ongoing formal training in group dynamics by Martin Marietta and motivational training by the Pacific Institute.

A training strategy is currently being developed to train all MSFC employees in continuous improvement. This training, scheduled to begin in February 1991, will provide a 2-day course for all MSFC supervisors and a 2-hour overview presentation to all Center employees. In addition, advanced training in the use of specific TQM methodologies will be offered as improvement teams are established to carry the continuous improvement effort forward.

Benefits Achieved:

The knowledge already gained from the various training experiences has served to focus Center CI efforts. The concentrated training effort scheduled to begin in February should further enhance the Center's TQM awareness.

Contact for More Information:

L. E. Lechner
205-544-5227

CATEGORY: Employee Training and Recognition

74. CREATION OF A CONSOLIDATED TRAINING MANUAL, IMPLEMENTATION OF TRAINING FACILITATION PROCEDURES, AND AUTOMATION OF TRAINING ADMINISTRATION

NASA Headquarters (Code HW)

Description of the Activity:

A training manual was developed that provides information on previously approved courses that are appropriate for all division personnel. The manual consolidates information from a wide range of training sources, including the Goddard Space Flight Center, the Department of Defense, NASA Headquarters, the U.S. Department of Agriculture Graduate School, NCMA, and MCI, with course descriptions, prerequisites, costs, and a schedule of dates where developed for the training manual. This manual sets forth recommended training courses by grade and by series; and clearly states the policies and practices necessary to successfully obtain training at Headquarters. In addition to providing all financial and tracking information, a data base for the division was designed and implemented which generates IDP forms and updates automatically as required. A new set of procedures was instituted which involves providing the front office with all completed training forms so they can routinely submit them on a regular basis after confirmation by the supervisor and employee.

Benefits Achieved:

- 1) This has had a significant impact on the morale of division personnel who are increasingly aware that division management is seriously interested in fulfilling their training needs. The consolidation of training information and specific guidelines has eliminated much of the confusion, employee frustration, and irrelevant training requests of past years
- 2) In fiscal year 1990 we have received proportionally twice as many training requests as last year. All training requests this year have been approved by each Code's Training Officer
- 3) The NASA Training Office is now developing several alternate plans for procurement training based on the rise in timely, relevant training requests and the availability of training costs and numbers from the division's automated system.

- 4) Training costs have been held down while training opportunities increased significantly due to the availability of alternate sources and ease of tracking similar courses and comparing their costs.

Contact for More Information:

Dennis Douvarjo
202-453-1852

CATEGORY: Employee Training and Recognition

75. MANNED FLIGHT AWARENESS (MFA) ACTIVITIES

NASA Headquarters (Code M)

Description of the Activity:

The NASA Government/Industry Manned Flight Awareness (MFA) Program is recognized as one of NASA's most successful, visible, and effective employee motivation programs. While stressing the criticality of crew safety, quality workmanship, and mission success, the Program offers prestigious recognition to employees and encourages a team concept by bringing together government/industry management, members of the Astronaut Corps, and other outstanding members of the workforce.

During 1990, the MFA Program introduced the NASA Flight Safety Award. Recipients of this new award were presented with a trophy by a member of the Astronaut Corps for significant contributions to further flight safety efforts. Final approval for the award is made by the NASA Flight Safety Panel and less than ten of these prestigious awards will be presented each year. In addition, the program continued to sponsor launch honoree events and astronaut visits to NASA centers, contractor and subcontractor plants, and vendor facilities for motivational purposes and award presentations. Planning continues for a special event in April 1991 to commemorate the 10-year anniversary of the first flight of America's Space Shuttle.

Benefits Achieved:

The MFA Program continues to improve the morale of the NASA government/industry workforce through employee recognition and the joint participation of employees and management in all of the MFA activities.

Contact for More Information:

C. Shannon Roberts
202-453-2386

CATEGORY: Employee Training and Recognition

76. OFFICE OF SPACE FLIGHT PROGRAM ANALYSIS TRAINING COURSES

NASA Headquarters (Code MR)

Description of the Activity:

The Office of Space Flight Resources Management Organization has employed Vision Analytics, Inc., a consulting firm to develop and present a series of training courses for resources and program analysis personnel. Course topics include "Basic Program Planning and Analysis" and "Techniques Employed in Quick Look Assessments". The course is taught by former NASA personnel and utilizes recent NASA case histories and real life examples to teach cost estimating and evaluation techniques.

Benefits Achieved:

The Program Analysis training courses improve resources personnel skills and job performance. Techniques applied on the job result in more thorough and complete cost estimates which ultimately reduces cost overruns.

Contact for More Information:

David K. Bates
202-453-2102

CATEGORY: Employee Training and Recognition

77. COOPERATION WITH EXTERNAL SOURCES TO INFLUENCE QUALITY AND PRODUCTIVITY IMPROVEMENTS

Headquarters (Code QB)

Description of the Activity:

NASA has a vested interest in keeping abreast of dynamic Total Quality Management (TQM) implementation strategies. Involvement includes educating and being educated on current continuous improvement practices through existing quality-oriented organizations, societies and universities. By serving on the Board of Directors of organizations such as the Quality and Productivity Management Association (QPMA), the Association for Quality and Participation (AQP) and the Columbia University Advisory Board for the Graduate School of Business, we are able to gain valuable information to pass on to our customers.

Benefits Achieved:

By exchanging information, attending seminars, and providing seminars in conjunction with our counterparts in societies and educational institutions, we maximize our training resources and are exposed to current continuous improvement methodologies which keep costs down. We focus on quality achievements of our customers and contractors and are better prepared to address TQM issues and concerns.

Contact for More Information:

Joyce Jarrett
202-453-8415

CATEGORY: Employee Training and Recognition

78. GEORGE M. LOW TROPHY: NASA'S QUALITY AND EXCELLENCE AWARD RECOGNIZES LARGE AND SMALL BUSINESSES FOR EXCELLENCE

NASA Headquarters (Code QB)

Description of the Activity:

The George M. Low Trophy: NASA's Quality and Excellence Award recognizes superior performance and continuous quality and performance improvement in both large and small NASA contractors, subcontractors, and suppliers.

The award was established in 1985 as the NASA Excellence Award for Quality and Productivity to:

- 1) Enhance public awareness of the importance of quality and productivity improvement to the nation's competitive position
- 2) Recognize, promote, and encourage outstanding achievements in quality and productivity among NASA contractors, subcontractors, and suppliers, and
- 3) Transfer superior methods and ideas to others in industry, government, and academia.

In 1990, the scope of the award program was broadened: the inclusion of a small business category encourages small business participation in this program with criteria and eligibility modified to provide a "level playing field" for both large and small companies.

On October 24, 1991, at the Seventh Annual NASA/Contractors Conference, NASA Administrator Richard H. Truly renamed the award the "George M. Low Trophy: NASA's Quality and Excellence Award," acknowledging George M. Low's commitment to quality and excellence.

On the evening of October 24, 1991, NASA Deputy Administrator J. R. Thompson announced the recipients of the 1990 George M. Low Trophy: NASA's Quality and Excellence Award: Rockwell International's Space Systems Division, Downey, California, and Marotta Scientific Controls, Inc., Montville, New Jersey, the first small business to receive this honor. Robert G. Minor, President, Rockwell Space Systems Division and Thomas S. Marotta, Chairman and President, Marotta Scientific Controls, Inc., were on hand to accept congratulations.

Benefits Achieved:

The award process provides a method for measuring quality and process improvement through analysis of progress in the following criteria elements: Customer satisfaction, productivity levels or trends, top management commitment and involvement, quality and productivity improvement plans, measures, and dissemination, open communication, training, work force involvement, award/reward recognition, health and safety, and vendor involvement. These criteria elements directly correlate with the elements of Total Quality Management. Furthermore, by evaluating the applicant organizations, NASA is provided with improvement techniques and methodologies which can be applied in the NASA organization.

George M. Low Trophy: NASA's Quality and Excellence Award recipients have saved NASA millions of dollars and work hours in improved processes. Rockwell Space Systems Division realized a savings of \$40 million with an on-time delivery as a result of a one-third reduction of manpower in fabricating OV-105, the new Shuttle Endeavor, with their subcontractors contributing over \$7 million in cost reductions during 1987-89. Marotta Scientific Controls, Inc., by investing in computer numerical control lathes and machining centers, averaged 20% reductions in delivery lead times and work hours for valve body series.

Contact for More Information:

Geoffrey B. Templeton
202-453-8415

CATEGORY: Employee Training and Recognition

79. EFFECTIVE USE OF MANPOWER

Stennis Space Center (SSC)

Description of the Activity:

Due to fluctuations in demanding requirements from Technical Services Division (TSD) customers, manpower requirements vary throughout the year. In order to fully maximize manpower usage, TSD has emphasized the cross-training of personnel. Technicians in the Component Shop are trained in all aspects of servicing techniques. A Technician who would normally work in the Disassembly Department can also function in the Clean Room assembly operation and also in the Test Cell or cleaning line. In order to maintain their proficiency, technicians are routinely assigned to different operations. This cross-training concept has extended to other divisions by loaning out personnel to other activities when work is slow in TSD shops. At present, four technicians can function in the Carpenter Shop; two as Electricians, two as plumbers, two as mechanics, and three who have worked in the warehouse. Two of the Machinists are also trained as, and have functioned as, Layout Specialists and helpers in the Weld Shop.

The reduction in Component Shop manpower has resulted in a steady increase in work processed through the facility (after an initial downturn in 1988).

Benefits Achieved:

By making more effective use of manpower, the Component Shop has reduced its staffing over the past three years from a high of 29 in October 1987, to 17 in September 1990. Efficiency and effectiveness per technician has increased significantly.

Contact for More Information:

John Lovitt
601-688-2348

CATEGORY: Employee Training and Recognition

80. EMPLOYEE AWARD AND RECOGNITION PROGRAMS

Stennis Space Center (SSC)

Description of the Activity:

Johnson Controls World Services, Inc., a contractor for SSC, enjoys recognizing the achievements and accomplishments of its employees and does so through a generous and fair awards system. Every employee is eligible and encouraged to submit Cost Reduction Suggestions and upon approval and implementation, up to 10% of first year savings (not to exceed \$10,000) may be awarded for tangible suggestions. Intangible suggestions or productivity improvements awards consist of products, gift certificates, or small monetary bonuses. Management employees are eligible for Management Incentive Program bonuses awarded semi-annually for outstanding performance. All employees, groups of employees, or whole projects may be nominated for the Johnson Controls Merit Awards from which the annual Chairman's Award for Excellence in Customer Satisfaction is chosen. The Facility Operations and Support Services/Stennis Space Center (FOSS/SSC) project won this coveted award in 1990. We encourage nominations to be submitted for NASA's Manned Flight Awareness Launch Honoree and Silver Snoopy Awards with our facility possessing many recipients. Recently, we initiated the "Top Gun" awards for individual outstanding performance. These awards are given in the work area in recognition of demonstrated customer satisfaction. The Safety Incentive Award program has also recently been revived. We have several Performance Teams which measure their performance using the Performance Objective Matrix and are awarded cash or U.S. Savings Bonds for sustained performance excellence. Teams are awarded plaques for highest performance and Divisions for lowest controllable absences. Annually, we submit our application for the George M. Low Trophy and the Association for Quality and Productivity (AQP) Organizational Excellence Award.

Benefits Achieved:

Our awards systems urge individual peak performance. We have seen tremendous improvements in motivation, morale and pride in performance through our recognition programs.

Contact for More Information:

John Lovitt
601-688-2348

CATEGORY: Employee Training and Recognition

81. EXCEEDING EXPECTATIONS: WINNING THE CHAIRMAN'S AWARD

Stennis Space Center (SSC)

Description of the Activity:

For SSC contractor Johnson Controls World Services, Inc's 42,000 employees worldwide, the greatest testimonial to having achieved "Excellence in Customer Satisfaction" is earning the Johnson Controls Chairman's Award for Excellence in Customer Satisfaction. In 1990, the World Services team at SSC achieved this milestone, having been selected to receive only one of five such awards presented in 1990.

Benefits Achieved:

The 490 employees of the Facility Operations and Support Services Project demonstrated their commitment to exceeding their customers expectations by earning 100 percent of their semi-annual award fee for three consecutive periods - a first in the NASA facility's history. Nowhere is this sentiment echoed more clearly than at World Services highly acclaimed Productivity Improvement and Quality Enhancement (PIQE) efforts through Total Quality Management and employee involvement. More than 60 percent of the project's employees have participated in PIQE-supported quality circles and task and performance teams engineered to improve the way employees work. The benefactors of these improvements are not only NASA ,but the employees themselves. Through their teams, employees have implemented cost reduction suggestions, research and development activities and awards/recognition programs.

Contact for More Information:

John Lovitt
601-688-2348

CATEGORY: Employee Training and Recognition

**82. SEMI-ANNUAL PRODUCTIVITY IMPROVEMENT AND QUALITY ENHANCEMENT
(PIQE) RECOGNITION AWARDS**

Stennis Space Center (SSC)

Description of the Activity:

Semi-annually, SSC Contractor Sverdrup Technology, Inc.'s management team recommend employees who have made exceptional contribution to the overall performance of Sverdrup's Technical Support Service contract with SSC. Recommended employees are evaluated and selected by the Sverdrup PIQE Steering Committee for the recommended award.

Benefits Achieved:

For calendar year 1990, the following number of awards have been distributed to calibration technicians in the following categories:

- Extra Miler: 3 Each
- Productivity: 7 Each
- Quality: 2 Each
- Safety: 1 Each

Contact for More Information:

Robert McTaggart
601-688-2140

EMPLOYEE EMPOWERMENT AND TEAMWORK

CATEGORY: Employee Empowerment and Teamwork

83. "EZ REPORT" FINANCIAL REPORTING SYSTEM

Ames Research Center (ARC)

Description of the Activity:

EZ Report is a special software system that allows authorized personnel direct access to the ARC financial management data base for purposes of on-line query and special report generation. This system was designed according to user generated requirements and developed with heavy user involvement. A steering committee was formed which included senior level staff assistants, resource specialists, and the contractor development team. Sub-committees were also formed to insure that user requirements from throughout the Center were identified. System requirements were identified through an extensive consensus evaluation process that also included recognition of development costs. The emphasis on teamwork and the empowerment of the employees in the design and development phase was also carried through to the implementation and training phases.

Benefits Achieved:

The efforts expended to thoroughly involve employees in the development of this system was also an example of "focus on the customer" since those involved in the development are also the primary users of the EZ Report system. EZ Report allows on-line users to easily build, test, modify, save, recall, and share financial reports. These reports are developed using an easy-to-use menu driven system. This capability has significantly reduced the number of standard hard copy reports that were previously generated centrally and delivered on a weekly or monthly basis. Savings have also resulted from the improved timeliness of financial information, the ability to identify and correct errors in the data, and in the flexibility to develop ad hoc reports.

Contact for More Information:

Larry Hofman
415-604-6666

CATEGORY: Employee Empowerment and Teamwork

84. MEASURING PRODUCTIVITY IN AN ENGINEERING ENVIRONMENT

Goddard Space Flight Center (GSFC)

Description of the Activity:

Three pilot projects to measure Productivity were begun by Unisys Corporation at the GSFC in support of GSFC Code 300 work. Each of the three Engineering teams set out to measure and assess productivity in their respective groups. The engineers used a Nominal Group Technique to identify elements to be measured and what the specific measurements should be. The elements of productivity to be measured included:

- Quality
- Quantity
- Effectivity
- Efficiency
- Timeliness

Each team determined the exact measures to be used. These measurements were placed on an Objective Matrix to weigh those factors most important to the team's mission. These measures are posted monthly on a wall titled "Engineering Productivity Indicators" (EPI) at the EPI Center. Each month the numbers are posted and individual events contributing to the scores are identified. In addition, the final score for the month is tracked on a rolling average to identify trends.

The difficulties of imposing metrics on the "knowledge" or "white collar" worker were overcome by using this method. For several months the numbers were tracked to adjust the scale. The measurement system continues to be "fine tuned" as everyone becomes more familiar with the measurements.

Benefits Achieved:

Immediate benefits were achieved in measuring Productivity. These benefits include a better understanding of the work process along with each individual's understanding of how each person contributes to the overall productivity of the department.

Examples of the overall improvement were seen in the NPO Support Group Productivity Indicator, which went from 81 percent in August 1990 to 91 percent in December 1990. The engineering team supporting the GSFC Parts Evaluations was able to identify timeliness problems and raise their Productivity Indicator score by 35 points, while correcting a problem that has a large impact on their productivity.

Contact for More Information:

John Schwabe
301-794-2702

CATEGORY: Employee Empowerment and Teamwork

85. REGULAR RESOURCES MANAGEMENT MEETING

Goddard Space Flight Center (GSFC)

Description of the Activity:

At the GSFC, the individual resources management people are organizationally a part of the line and staff offices they serve, unlike other Centers and/or Center functional organizations that are centrally organized and managed. Although this is fitting for an organization as programmatically diverse as the GSFC, it does cause problems in coordination, training, and career growth.

In order to solve the Center's problems with resources management coordination, etc., while preserving the strength of a diffuse resources management structure, the GSFC Comptroller has initiated a monthly meeting, or "Resources Forum", of top Center resource managers to solve Centerwide problems.

Benefits Achieved:

The monthly Resources Forum has resulted in the development of a resources training committee that has begun to provide a curriculum of courses and/or sessions in the various phases of resources management. Initial courses have been developed and classes have been held.

Another subcommittee is developing a Centerwide "Resources Co-op" program to help increase the intake of new entry-level resource specialists. The initial intake of co-ops will occur in the Summer and Fall of 1991.

In addition to the above specific accomplishments, regularly scheduled meetings improve communications among the resources group. Problems can be articulated early, and mutually acceptable solutions can be developed and implemented quickly.

Contact for More Information:

Charles Tulip
301-286-7947

CATEGORY: Employee Empowerment and Teamwork

86. MODELING OF PLANAR QUASI-TEM SUPERCONDUCTING TRANSMISSION LINES

Jet Propulsion Laboratory (JPL)

Description of the Activity:

A mathematical model for the microwave behavior of a planar quasi-Tem transmission line was developed by Dimirios Antsos, a graduate student at Caltech and a part-time worker in the Spacecraft Telecommunications Equipment section at JPL. The equations were reduced algebraically to obtain explicit formulas so they could be entered into MathCAD and a touchstone circuit file for modeling and design purposes. Validation of the model was accomplished by comparing the computer analysis with measured values.

Benefits Achieved:

Complete modeling of low and high critical temperature, superconducting, microwave circuits is now possible using commercially available conventional microwave software packages. This design and analysis capability significantly reduces the time and cost of designing, cryogenically colling and testing, and then redesigning, building, and testing microwave superconducting circuits.

Contact for More Information:

Robert C. Clauss
818-354-7536

CATEGORY: Employee Empowerment and Teamwork

87. SHORT FORM FEDERAL INFORMATION PROCESSING (FIP) ACQUISITION PLAN

Johnson Space Center (JSC)

Description of the Activity:

There was general consensus at JSC that the acquisition planning process for FIP resources was too lengthy, involving a drawn out approval cycle which required a number of unnecessary steps. A great deal of technical manpower was being spent on acquisition planning activities, and these activities were expected to increase significantly due to the passage of PL 99-500 and the accompanying publication of an implementing Federal Information Resources Management Regulation (FIRMR). A tiger team was formed to study the acquisition process. This team was led by the Information Systems Directorate (ISD), with representatives from several other Directorates as well as Procurement. The acquisition process was flow charted and two primary areas were identified over which JSC had control; the signature cycle and the volume of data required for relatively small procurement. These areas formed the focus of the tiger team's activities.

Benefits Achieved:

Concentrating on acquisition plans for equipment less than \$1 million in value (\$250 million for non-competitive acquisitions), the team reviewed each required signature asking, "What is the value added by this person signing this document?" This resulted in the appointment of the Director, ISD, as the Center signatory, with the number of total required signatures changing from 17 (the most extreme case) to 4. This not only shortened the approval time (a time savings of 2-3 weeks), but also focused authority and minimized the number of editorial reviews each acquisition plan received. It is estimated that the revised signature cycle will save approximately 16 work hours per acquisition plan.

Next, the team analyzed regulations driving content of the acquisition plans. As a result, a standardized, short form acquisition plan was developed which reduced the number of pages of information required for the nominal case from about 12 to 3 (the 2-page short form plan plus an automated cost analysis). Approximately 24 work hours are saved per acquisition plan with this short form.

Based on 342 plans processed during fiscal year 1990 and an anticipated increase in future years, it is estimated that there will be 400 acquisition plans per year for FPI resources of less than \$1 million in value (\$250 million for non-competitive acquisitions). At a total savings of 40 work hours per acquisition, annual dollar savings are expected to be \$400,000.

Contact for More Information:

Elena Huffstetler
713-483-4078

CATEGORY: Employee Empowerment and Teamwork

88. UNISYS MAINFRAME/NETWORK CONSOLIDATION

Johnson Space Center (JSC)

Description of the Activity:

The Information Systems Directorate (ISD) and the Mission Operations Directorate (MOD) combined the ISD Unisys 1194P and the MOD 1192S Unisys Mainframe processors and networks into one Unisys complex to achieve efficiency in Automated Data Processing (ADP).

The impetus to combine the work in a single complex came from the Information Resources Management (IRM) Council. Teamwork was required between three directorates to accomplish this task. The combining of work involved a team effort between the ISD and the MOD as well as their support contractors MDSC and RSOC. Weekly meetings were required to iron out the many technical problems involved with this task. In addition, the Engineering Directorate set the stage by moving their workload from the Unisys to the Cray processor on a relatively tight schedule before the Unisys workload could be combined.

Benefits Achieved:

Combining the processors and networks into a Unisys complex allowed ADP maintenance and operational costs to be consolidated under the MOD. A duplication of ADP maintenance and operational costs was eliminated and will yield an estimated cost savings of \$1.3 million in fiscal year 1991, \$1.5 million in fiscal year 1992, \$1.5 million in fiscal year 1993, and \$1.5 million in fiscal year 1994.

Contact for More Information:

Leroy D. Villarreal
713-483-7582

CATEGORY: Employee Empowerment and Teamwork

89. GRUMMAN QUALITY ACTION TEAM STREAMLINES STANDARD PRACTICE INSTRUCTIONS

Kennedy Space Center (KSC)

Description of the Activity:

A Grumman Quality Action Team investigated the processes for distributing and updating Standard Practice Instructions (SPI's) at their sites at KSC. The team discovered that more than 15 hours per month were used to update each of 38 volume sets. The team determined key areas to locate the volume sets, reducing the total number of sets by 65 percent while increasing user accessibility.

Benefits Achieved:

The labor and paper utilized each week for updates was reduced by 65 percent, with an annual cost savings estimated at \$102,000. The SPI volumes are more accessible to all shifts, with a designated individual responsible for updates, ensuring that employees have access to up-to-date information.

Contact for More Information:

Jacqueline Goris
407-867-5578

CATEGORY: Employee Empowerment and Teamwork

90. TAPE/DATA RETENTION WORKING GROUP

Kennedy Space Center (KSC)

Description of the Activity:

A Tape/Data Retention Working Group with membership from all KSC organizations was established to determine appropriate retention periods for technical tapes and records. The purpose is to assure all technical tapes and records are being stored appropriately and unneeded tapes and data are disposed of to free up needed storage space.

Benefits Achieved:

The Tape/Data Retention Working Group identified 6,000 boxes of paper data for destruction, pending final approval by authorities at the National Archives. Another 4,000 boxes of paper data have been identified for shipment to the Federal Records Center. Follow-on activities will also result in magnetic tapes being identified for release/recycle.

Contact for More Information:

Judith Kersey
407-867-7390

CATEGORY: Employee Empowerment and Teamwork

91. CREATION OF STRATEGIC CULTURE ASSESSMENT FOR THE NINETIES (SCAN) TEAMS

Langley Research Center (LaRC)

Description of the Activity:

The Center Director established employee Strategic Culture Assessment for the Nineties (SCAN) teams to freely examine three major areas for improvement as a result of the Agency's cultural analysis: communications, awards and recognition, and career development. The teams were given wide latitude to assess the Center's strengths and weaknesses in these areas and to report their findings and recommendations to the senior staff.

Benefits Achieved:

The SCAN teams presented their findings with 61 recommendations for improvement during the senior staff's summer strategic planning retreat. The recommendations represented sweeping cultural changes and, while several proposed changes were immediately approved, many required further coordinated study with the senior staff. By the end of 1990, about half of the 61 recommendations were adopted in the areas of merit promotion, incentive awards, employee development, and a variety of communication improvements. The remaining recommendations continue to be vigorously addressed by the SCAN teams and the senior staff.

An employee forum was created as an additional way to improve communications. The Center will start in January 1991 a continuing series of bi-monthly employee meetings at the Director, Director for, and Division Chief levels. The meetings will be open to employees and supervisors and will generally be held with groups of 25. A broad spectrum of issues will be addressed and the format of the meetings will be tailored to the needs of each organization. The Director will kick off the forum by visiting each directorate to talk with supervisors and employees about his views for providing effective management operations.

Contact for More Information:

Richard R. Antcliff
804-928-4606

CATEGORY: Employee Empowerment and Teamwork

**92. LANGLEY RESEARCH CENTER FABRICATION DIVISION QUALITY CIRCLE
"MINI MINDER" (PAMPHLETS ON OVERTIME, TRAVEL, AND
CORRESPONDENCE)**

Langley Research Center (LaRC)

Description of the Activity:

"Mini Minder" is a name given to small pamphlets distributed to all personnel in the Fabrication Division to offer a quick reference on a variety of topics. These provide valuable information to each person regarding topics of most concern to them.

Benefits Achieved:

Benefits have been realized for over 300 people. The Fabrication Division has seen immediate results by their personnel in understanding, submitting properly, and having fewer questions to be answered on all overtime questions/submittals, travel authorizations and vouchers, and NASA Correspondence. Regarding NASA Correspondence, with the advent of personal computers it is critical that each employee becomes familiar with the proper and necessary rules and regulations pertaining to correspondence. Since the Correspondence Handbook (1450.1) is only distributed to secretaries and administrative assistants, this "Mini Minder" was created. It reminded the staff that correspondence regulations must be followed and if they were not going to utilize the knowledge and skills of their secretaries they should at least familiarize themselves with the proper format and routing required for four of the most widely produced letters: Business; Personalized; Intra-Agency; and Interoffice. This has saved hours of re-work on letters and memorandums prepared by personal computer users. The Mini Minder has been so effective that organizations outside the Fabrication Division have requested copies for their personnel.

Contact for More Information:

Nadine McHatton
804-928-4561

CATEGORY: Employee Empowerment and Teamwork

93. FOURTH ANNUAL NASA EMPLOYEE TEAM (NET) RECOGNITION PROGRAM

Marshall Space Flight Center (MSFC)

Description of the Activity:

Marshall Space Flight Center's Fourth Annual NET Recognition Program/Luncheon was held on June 26, 1990, at the Redstone Officer's Club. This program honored 14 teams from various organizations across the Center who are engaged in refining work processes by examining their areas of work and looking for ways to improve and streamline Center operations.

Following an introduction by C. D. Bean, Director, Administrative Operations Office, Associate Director, J. A. Bethay gave remarks concerning the NET process at MSFC and presented special awards as follows:

- 1) The Douglas F. Sandbridge NET Leadership Award, which is presented annually to the NET Leader who best exemplifies participative leadership. The 1990 recipient was Ms. Julia McNeal
- 2) The NET Champion Award, also presented annually to a supervisor or manager who supports the NET process by work and action was presented to Mr. Wiley Bunn of the Quality Assurance Office
- 3) Outstanding NET Member Awards were presented to six NET facilitators who serve as process consultants to the teams for their invaluable support to the team process
- 4) Director's Commendations were presented to six NET facilitators who serve as process consultants to the teams for their invaluable support to the team process
- 5) Group Achievement Awards were presented to 11 teams
- 6) The Center Director's Annual NET Award of Excellence was presented to the team which best exemplifies the participation process. This year's recipient was the NETWORQ-NASA Employee Team working on restoring quality.

Benefits Achieved:

The NETWORQ worked three projects this year, all relating to the improvement of information transfer from the experienced engineers in the division to those more recently hired. The first is the Design Data Handbook or "Stuff" book. This book is a compilation of useful information necessary to structural designers including applicable specifications for a wide range of hardware items, materials, coatings, etc., as well as a handy reference for various engineering formulas and unit conversion factors. This was assembled using input from the experienced engineers in the division with the purpose of providing quick and easy access to the most pertinent design information. This book was distributed to all division personnel and other S&E laboratories by the NETWORQ members.

The second project, completed in April 1991, is a Design Philosophies book. This book also draws on the knowledge of experienced engineers in the Structures and Dynamics Laboratory. It is mainly a compilation of seminars and classes and design hints from several experienced design engineers, with additional information provided where needed. This volume will supply the young engineers with a wealth of knowledge that is otherwise attainable only through experience.

The third project is a Design Resources Directory. This document will provide everyone in the division the ability to quickly locate necessary books, specifications, and other important design information which is physically available within the division. The intangible benefits of these three projects are significant and extend throughout Science and Engineering. The transfer of knowledge these references provide will increase the productivity of hired engineers. These publications will improve access to more information in less time by concentration of this information.

The MSFC NET process is in its seventh year and, has resulted, to date, in significant cost savings and cost avoidance for the Center. Ms. Rosa M. Kilpatrick was named Center NET Coordinator in August 1990 while Ms. Carolyn McMillan completes a one-year assignment at Headquarters.

Contact for More Information:

R. M. Kilpatrick
205-544-0042

CATEGORY: Employee Empowerment and Teamwork

94. SOFTWARE MAINTENANCE IMPROVEMENT PROGRAM

NASA Headquarters (Code DT)

Description of the Activity:

Over the past two years, the Headquarters Information Systems and Technologies Division (Code DT) working with the Information Systems Group (ISG) of the Planning Research Corporation, has embarked on a program to dramatically reduce the cost to maintain NASA HQ Information Systems and to substantially increase the utility and reliability of NASA Systems.

Benefits Achieved:

The dramatic success of the program has enabled the DT/ISG team to reduce the resources required to maintain NASA's Information Systems by more than 50 percent (e.g.: the number of people required to support the Headquarters Information Systems and Technologies. Resources were reduced from 56 to 26 personnel), saving over \$2,000,000 per year in systems maintenance and enabling rapid response to system changes mandated by regulatory, policy, and law changes.

The resources required to support the Headquarters and the Headquarters maintained Agency financial systems and the payroll systems were both reduced from 12 persons, 2-1/2 years ago, to six today. Other systems which are maintained by the Headquarters Information Systems and Technologies Division were reduced over the past two and a half years by fractions of person years, which total to more than 18 person years of reduction per year to sustain and enhance the Headquarters operational systems. The resulting reduction of personnel to maintain the Headquarters operational information systems was more than 30 person years per year.

Software development and maintenance costs typically increase in multiples. The resource reduction of more than 50% in maintenance engineering is especially dramatic, substantially large, highly unusual, and noteworthy in the software business. All systems have become extremely reliable, with a minor program problem becoming a major noteworthy event, especially since the software age averages between 5 and 15 years old.

Contact for More Information:

Ronald W. Collison
202-453-2155

CATEGORY: Employee Empowerment and Teamwork

95. ESTABLISHMENT OF A TOTAL QUALITY MANAGEMENT (TQM) WORKING GROUP

NASA Headquarters (Code G)

Description of the Activity:

NASA Headquarters Code G has established a TQM Working Group to consider office problems and to make recommendations leading to increased quality, productivity, and efficiency in office operations. The group is chaired by the Deputy General Counsel and has six members, representing all elements of the office. The group meets 3-4 hours each month. In support of the group's activities, the General Counsel, by memorandum, informed all Code G employees of the group and invited suggestions to enhance operations. Later, the General Counsel met with the group to review issues raised and to discuss potential solutions and improvements.

Benefits Achieved:

The primary benefit of the aforementioned activity has been enhanced communication and understanding at all levels. This benefit alone has justified the group's activities. Additionally, specific issues have been addressed and new approaches have been agreed to. For example, to enhance vertical communications, the General Counsel and Deputy General Counsel will periodically attend sub-Code staff meetings. To enhance horizontal communications as well, a new approach to sharing information among the subcodes was agreed to. The group's activities have, overall, enhanced office operations and, importantly, team building.

Contact for More Information:

Gary Tesch
202-453-8608

CATEGORY: Employee Empowerment and Teamwork

96. COMMONALITY WORKING GROUP ELIMINATED THE REQUIREMENT TO PROVIDE A NEW EXTRAVEHICULAR MOBILITY UNIT (EMU) TO SPACE STATION

NASA Headquarters (Code MEO)

Description of the Activity:

A Space Station Program/Space Station Freedom (SSP/SSF) Commonality Group was formed in late 1988 and focused on a common EMU for SSF and SSP. This was accomplished in March 1990. The approach will be to change the current SSP's EMU to meet the Extravehicular Activity requirements for both programs.

Benefits Achieved:

An estimated savings of \$500 million over a 10-year period will result from this accomplishment.

Contact for More Information:

Keith Hudkins
202-453-2585

CATEGORY: Employee Empowerment and Teamwork

97. RELIABILITY BEST PRACTICES DEVELOPMENT

NASA Headquarters (Code QR)

Description of the Activity:

Working with each participating NASA Center, reliability related issues are identified. Solutions are proposed and a consensus of technical opinion is reached that results in identifying a best operating practice. Practices are based on Center sponsorship and a recognition that the selected approach has been applied to successful space flight missions.

Benefits Achieved:

Intercommunication between NASA Centers regarding techniques that have been used to significantly contribute to mission success.

Contact for More Information:

Ronald Lisk
202-453-1864

CATEGORY: Employee Empowerment and Teamwork

98. EXCHANGE OF LABORATORY ACCOMPLISHMENTS THROUGH CROSS-VISITS

Stennis Space Center (SSC)

Description of the Activity:

Two calibration technicians from the Duke Power Company in Charlotte, N.C., visited SSC to tour the calibration facility and observe our method of calibration for a specific laser alignment device. In return, a SSC supervisor and a calibration technician visited the Duke facility in Charlotte to observe their laboratory operation.

Benefits Achieved:

As a result of the visits and subsequent exchange of information, the SSC technician is implementing a modification to our Bell Prover Flow Standard that will result in the savings of several thousand dollars through calibration time reduction.

Contact for More Information:

John Wimbrow
601-688-2028

CATEGORY: Employee Empowerment and Teamwork

**99. SUBSTITUTION OF SPOOL SECTION FOR FAILED VALVE TO AVOID
SPACE SHUTTLE MAIN ENGINE (SSME) TEST IMPACT**

Stennis Space Center (SSC)

Description of the Activity:

Following the discovery of two cracked 24-inch water valves at the A2 Test Stand for which there was only one spare available, a temporary workaround was implemented which prevented an impact to the SSME Test Program. An initiative to replace one of the faulty valves with an open spool section was incorporated since the valve stayed in an open position approximately 99 percent of the time, and could be isolated by other means if requested. This was an innovative approach by Sverdrup Technology, Inc., and SSC to a critical problem which had not been previously recognized.

Benefits Achieved:

The workaround avoided an impact to the SSME Test Program of approximately 3 weeks, which was the estimated time required to obtain a replacement valve on the fastest delivery possible. In addition to the program impact, the nonproductive time for the test contractor for this delay was calculated to be over \$330,000. Other areas and applications are also being surveyed to determine if this same idea can be incorporated to reduce the spares requirements previously established.

Contact for More Information:

H. G. (Jerry) Hagoort
601-688-2251

CATEGORY: Employee Empowerment and Teamwork

100. SUGGESTION TO MODIFY THE LEUPOLD STEVENS RECORDER

Stennis Space Center (SSC)

Description of the Activity:

The modification centers around the ferrous steel strip that is glued to an aluminum actuator lever in the punch pen package of this recorder. It has been determined that 75 percent of all failures in this recorder occur when the glue that bonds this strip to the actuator lever deteriorates to the point that the strip falls off the actuator lever. When this occurs, the punch pins cannot be actuated to the punch position and ultimately cannot punch the paper tape record.

Benefits Achieved:

The suggestion minimized this potential failure by reinforcing the bond between the strip and the actuator lever and generating a documented maintenance savings of \$15,870.

Contact for More Information:

Robert (Mac) McTaggart
601-688-2140

MEASUREMENT AND ANALYSIS

CATEGORY: Measurement and Analysis

101. AN INTERACTIVE GRAPHICAL PRE-PROCESSOR FOR 3D ELLIPTIC GRID GENERATION

Ames Research Center (ARC)

Description of the Activity:

Computational Fluid Dynamics (CFD) has become an accepted component in the aerodynamicist's kit of tools. But a consensus is emerging that generating computational grids (the networks of points at which the numerical solutions are actually found) is the major bottleneck in the application of CFD to realistic problems. A recent NASA ARC workshop on the subject concluded that 50 to 80 percent of the CFD practitioner's time is spent on grid generation.

Much of that grid generation time is spent collecting and formatting input for the grid generation program. A grid consisting of multiple blocks fitted together is found necessary in applying CFD to most realistic aerodynamic problems, and even relatively simple multiple-block grids require that hundreds (if not thousands) of lines of input data be collected and formatted. Obviously, any computational tool which facilitates this process is of great value.

The new computer program 3DPREP is such a tool. It is a highly interactive graphics program, running on a powerful scientific workstation. It is a preprocessor which assists the scientist or engineer in collecting and formatting input data for the proven NASA ARC grid generator program 3DGRAPE. Thus it stands by itself as a productive and functioning system, and it serves as a proof-of-concept for other such tools.

The program offers the user attractive and functional screen layouts, having a dialogue entry facility for the novice, a random access facility for experts to use in entering new data cases or modifying existing cases, a collection of useful computational utilities, plotting of surfaces with rotation and translation, and context-sensitive on-line help. The ultimate product of the new program is data files which are formatted for use as input to the grid generator. Thus the user can create or modify grid generation data quickly and easily.

The new 3DPREP program consists of approximately 45,000 lines of "C" language, complimenting 3DGRAPE's 15,000 lines of FORTRAN. The new program is in the alpha-test phase (in use by a small collection of local users). Plans are to release it shortly in beta-test (use by others, at remote locations, but with close communication between developer and user), and later to transfer it to COSMIC (the Computer Software Management and Information Center) for general release.

The next step in this research into reducing the burden of grid generation is to combine the new input pre-processor with the grid generator in a more complete grid generation system. This is an ambitious project because the pre-processor must run on a workstation to have the graphical capabilities it requires, but the grid generator must run concurrently on a supercomputer to have the required computing power. Linking the two programs, running concurrently on two different computers, is a non-trivial task. Future plans also include adding other grid generation software, such as grid-quality measurement tools.

Benefits Achieved:

Test have shown that the use of this new program can reduce the time required to generate a grid by a factor of ten.

Contact for More Information:

Reese L. Sorenson
415-605-4471

CATEGORY: Measurement and Analysis

102. REDUCTION OF TIME REQUIRED TO PERFORM WIND TUNNELS TESTS

Ames Research Center (ARC)

Description of the Activity:

Data acquisition and reduction in the ARC Unitary Plan Wind Tunnels is performed using the ARC Standardized Wind Tunnel System (SWTS). The Data Gathering Processor (DGP) of the SWTS provides data acquisition, averaging and display in real time. The DGP acknowledges completion of data acquisition and processing by displaying a message on a CRT screen. The tunnel operator may then move the model to the next position without effecting the data. Analysis of the data acquisition times indicated there was a delay of four to six seconds and occasionally longer, depending upon the test, between the time data acquisition had been completed and when the message was displayed on the CRT.

The DGP software was modified by support service contract programmers to provide two distinct digital signals. The first signal acknowledges that data acquisition has completed and the model can be repositioned without effecting data quality. The second signal acknowledges that all remaining data processing is complete and the data system is ready to acquire more data. These two signals trigger display lights at the operator's console. They may also be sent to an automatic model positioning system. Provisions have been made to use one, or the other signal, or both, as the case requires.

Benefits Achieved:

It has been estimated that the first signal, permitting model repositioning immediately after data acquisition has completed, will save a minimum of two seconds per data point. In 1990 approximately 70,000 wind-on data points were acquired at Unitary. The time savings realized through implementation of these signals will be about 39 hours. The minimum value of the occupancy time saved will be about \$117,000. At an average drive power of 100 megawatts (MW) and a marginal cost of \$75 per MW-hour, the energy savings to acquire the same number of points will be approximately \$290,000.

Contact for More Information:

Alan D. Levin
415-604-5878

CATEGORY: Measurement and Analysis

103. GLOBAL DIGITAL DATA SETS FOR THE STUDY OF GLOBAL CHANGE

Goddard Space Flight Center (GSFC)

Description of the Activity:

As part of the GISS Eos project, global data sets on the atmosphere, ocean, and land surface have been compiled and made available to the scientific community for multidisciplinary research about the Earth system. The collection includes satellite data such as cloud properties and vegetation index, conventional ground-based data such as 200 years of global surface air temperatures, and map data such as vegetation, soils, wetlands, and agricultural activities. The data are gridded in a self-consistent format, and are available either as an atlas for visual inspection and comparison or digitally via Internet for manipulation and analysis.

Benefits Achieved:

This multidisciplinary data archive is a first step toward the understanding of interactions among Earth system processes. The data are easily accessed via Internet by researchers at universities and other institutions. From the wide scientific application of the data we will learn how to improve on the data collection and analysis procedures.

Contact for More Information:

Inez Fung
212-678-5590

CATEGORY: Measurement and Analysis

104. MISSION OPERATIONS AND DATA SYSTEMS DIRECTORATE INFORMATION NETWORK (MODSIN).

Goddard Space Flight Center (GSFC)

Description of the Activity:

The purpose of MODSIN is to provide a common tool for developing and maintaining Mission Operations and Data Systems Directorate (MO&DSD) related technical and management information which will ensure Directoratewide standardization for processing and reporting to Center and Headquarters management. The management approach used to develop the MODSIN system was as follows:

- 1) The project was made a Level 1 project and was assigned a Project Manager responsible for the design, development, implementations, and maintenance of the system
- 2) A MODSIN Steering Group was appointed with representatives from all MO&DSD Divisions and offices, and was chaired at the Directorate level. The Steering Group defines policies, reviews and approves MODSIN applications, reviews MODSIN and related local system development plans, establishes applications priorities, reviews the impact of new functional requirements on MODSIN, establishes user groups for each application, and assigns a Data Base Administrator (DBA) for each application
- 3) The DBA establishes and presides over a MODSIN Application Working Group and is responsible for generating requirements acceptable to all the participating users. In addition, the DBA is responsible for directing training, testing, technical documentation development, and final release of the application subsystem
- 4) The Data Base Manager (DBM) receives the requirements from the DBA and introduces them to the Project Team for analysis and scheduling. He/she then becomes the liaison between the DBA and the System Integration Team (SIT). The DBM is responsible for user authorization, change requests, the user assistance center, and configuration management
- 5) The System Integration Team designs, develops, and maintains MODSIN applications.

The above management approach has enabled the SIT to implement several operational applications which are in use across the Directorate. The Steering Group establishes a list of the top ten applications to be developed. Six of the ten applications have been placed in operation during 1990. The other four applications have working prototypes being evaluated by the working groups.

Benefits Achieved:

The benefits of the MODSIN System can best be seen in the implementation of the Budget subsystem. This system produces the Work Authorization Document Charts and the Planning Documents which are electronically passed to the Center system. It has successfully standardized the processing and reporting of resources and technical information across the Directorate. The system has substantively reduced the number of overtime hours worked during a budget cycle and eliminated dual data entry at the Center level.

Contact for More Information:

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CATEGORY: Measurement and Analysis

105. SPECIAL SENSOR MICROWAVE/IMAGER (SSM/I) GLOBAL PRECIPITATION CLIMATOLOGY PROJECT (GPCP) MONTHLY RAINFALL INDICES

Goddard Space Flight Center (GSFC)

Description of the Activity:

The GPCP was established in 1987 by the World Meteorological Organization/International Council of Scientific Unions (WMO/ICSU) World Climate Research Programme (WCRP) to provide global fields of area and time averaged precipitation for the ten-year period 1986-1995. The GPCP will obtain global estimates of monthly precipitation totals averaged over 2.5 degrees latitude by 2.5 degrees longitude areas through utilization of available rain gauge observations and the innovative use of existing satellite infrared and microwave data, rather than rely on the implementation of any new observing or measurement programs. The GSFC is the designated center to provide the rainfall estimates from satellite microwave data.

Benefits Achieved:

This work produced the first monthly precipitation estimates over oceans using SSM/I data. An algorithm for estimation from histograms of SSM/I brightness temperatures has been developed. There are three novel features to this algorithm. First, it uses knowledge of the form of the rainfall intensity probability density function to augment the measurements. Second, a linear combination of the 19.35 and 22.235 GHz channels has been employed to reduce the impact of variability of atmospheric water vapor. Third, an objective technique has been developed to estimate the rain layer thickness from the 19.35 and 22.235 GHz brightness temperature histograms. A three year data set has been produced and delivered to the GPCP project. Comparison with climatologies and the Global Atmosphere Tropical Experiment (GATE) radar observations suggest that the estimates are reasonable in spite of not having a beam-filling correction. This algorithm and the experiences gained from this effort could be used by the future Tropical Rainfall Measurement Mission (TRMM) project monthly rainfall retrieval.

Contact for More Information:

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CATEGORY: Measurement and Analysis

106. CONTRACTOR PRODUCTIVITY IMPROVEMENT AND QUALITY ENHANCEMENT (PIQE)

Jet Propulsion Laboratory (JPL)

Description of the Activity:

Division 37 has continued a leadership role in productivity by developing unique methods of motivating its support contractor to continuously improve the efficiency and effectiveness of the contractor's efforts. The Division's Mission and Computing Support (MACS) contract encompasses over 400 personnel that consist of five major functional areas:

- 1) Contract Management Office
- 2) Systems Development
- 3) Mission Operations
- 4) Information Processing, and
- 5) Logistics.

One-fourth of the contractor's available Award Fee is allocated for award to the contractor for PIQE accomplishments. As a result, the MACS contractor established a formal PIQE Program and vigorously pursues PIQE initiatives in the following categories:

- | | | |
|----|--|-----|
| 1) | Improve Work Approaches and Procedures | (P) |
| 2) | Effective Operational Management | (M) |
| 3) | Automations | (A) |
| 4) | Effective Human Resources Management | (H) |
| 5) | Cost Avoidance | (C) |
| 6) | Enhanced Effectiveness | (E) |

The contractor documents his performance in each of these categories as measured in dollars, labor hours saved, and cost avoided. All claimed PIQE accomplishments are validated by a cognizant JPL supervisor.

Benefits Achieved:

During fiscal year 1990, the MACS contractor implemented 61 PIQE initiatives. These initiatives resulted in 6,005 labor hours saved and over \$435 million in costs saved or avoided. Since many of the initiatives will continue to generate savings to the end of the contract, the four-year projection of costs saved or awarded is \$4.7 million. The Award Fee awarded to the contractor for PIQE accomplishments was less than 12% of the projected savings over the remaining contract period.

Contact for More Information:

E.K. Davis
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CATEGORY: Measurement and Analysis

107. RAPID RADIOMETRIC MEASUREMENTS OVER LARGE AREAS

Jet Propulsion Laboratory (JPL)

Description of the Activity:

It has always been difficult to make measurements of thermal flux or irradiance over large areas. A new technique developed by the JPL can be used to obtain rapid measurements of the incident flux distribution over a broad spectral range at specific locations relative to heat sources such as infrared lamps or lasers. The technique originally was developed to verify efficiently the uniformity of irradiance that would be produced by a complex array of quartz-tube heat lamps and reflector elements over a large spacecraft solar panel during thermal vacuum-chamber tests. Lamp arrays for such tests can become very large spatially and very complex geometrically so that precise mathematical modeling is difficult and laborious. Calorimetric calibrations, on the other hand, are tedious and very time consuming. An imaging infrared radiometer is used in the new technique.

Benefits Achieved:

The new technique can be used in real-time and can provide useful data on irradiance distribution rapidly over large areas (many square miles) to an absolute accuracy of approximately ten percent. Significantly better accuracy can be obtained when testing is performed in a vacuum chamber without the uncertainty of air convection. This technique greatly reduces set-up time for tests or experiments, thereby saving funds. Also, irradiance profiles or distributions can be obtained rapidly following real-time adjustments in heat source geometry.

Contact for More Information:

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CATEGORY: Measurement and Analysis

108. CONTRACTOR'S EMPLOY STATISTICAL PROCESS CONTROL TO IMPROVE OPERATIONS

Johnson Space Center (JSC)

Description of the Activity:

The JSC contractors have realized significant benefits from the application of statistical process control techniques to their operations. For example:

- 1) Rockwell International, Space Systems Division (RISSD), established a goal to improve process controls and implement statistical process controls (SPC) for selected operations at both the Downey and Palmdale backshop facilities. Processes were assessed and candidates selected to determine process capabilities and variabilities. Some 80 process types were surveyed and included in the study; typical examples were brazing, cleaning, bonding, polishing, thermal protection system (TPS) tile fabrication, and drilling. Nearly 400 surveys were conducted, with initial focus areas targeting the TPS tile and softgood fabrication areas located in Palmdale
- 2) Lockheed Engineering and Sciences Company (LESC) established a Total Quality Management (TQM) team to investigate the LESC procurement process. Data gathered on current and prior year procurement activities was organized into a common format to support SPC analysis. This provided, for the first time ever, a rigorous and quantitative assessment and characterization of the elements comprising the procurement process. Analysis identified high leverage areas where relatively low-cost change could yield substantial quality improvements and reduce cost.

Benefits Achieved:

At Rockwell, notable successes included:

- 1) TPS tile coating anomalies reduced 87 percent over the first 9 months of SPC
- 2) TPS tile yields of over 92 percent maintained over the first year of applying SPC
- 3) In-line inspection redeployed on advanced flexible reusable surface insulation fabrication due to the success of the manufacturing process.

At LESC, a signature requirement in excess of Federal Acquisition Regulations for small procurements between \$1,000 and \$2,500 was eliminated and preparation-to-placement interval for this category of procurements was reduced by 23.4 percent. In addition, increased awareness of system efficiency across the procurement process resulted in a reduction of 15 percent in average preparation-to-placement interval for all procurements.

Contact for More Information:

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CATEGORY: Measurement and Analysis

109. DELETION OF TWO SHUTTLE ORBITER VENT DOORS

Johnson Space Center (JSC)

Description of the Activity:

The Space Shuttle Orbiter is vented during ascent and repressurized during descent to reduce structural loading and minimize structural weight. Eighteen vents (nine on each side) provide venting for the Orbiter fuselage, wings, and Orbital Maneuvering System pods. Electrical mechanical vent doors at each vent location control the flow of gases entering and exiting the various Orbiter compartments during ascent, on-orbit, entry, and ground purging. Ten of the 18 vents are dedicated for venting the mid-fuselage and both wings. These vents are commonly referred to as left-hand and right-hand vents 3, 4, 5, 6, and 7. Sizing and location of the vents were based on wind tunnel tests early in the design phase of the Orbiter. Flight data, however, showed the local pressure coefficients during ascent and descent were different than those measured from the wind tunnel tests. Consequently, the JSC Structures and Mechanics Division (SMD) vent models were revised and a study was conducted to evaluate the importance of each vent using the flight-derived models.

The venting analysis performed with the revised SMD models showed it was feasible to delete both the left- and right-hand vents 4 and 7, and to vent the wings into the lower mid-fuselage without significant increase in the flight differential pressures. The recommendation to delete vents 4 and 7 was presented to NASA management and accepted.

Benefits Achieved:

Deletion of the vents and associated hardware will provide a total weight savings of 182 pounds and decrease Orbiter turnaround time due to elimination of checkout for the deleted doors. Improvements which provide Orbiter weight savings are particularly significant for two reasons: 1) weight reduction produces programmatic gains in Shuttle margins and flexibility and 2) many hardware changes made following the Challenger accident significantly increased Orbiter weight.

Contact for More Information:

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CATEGORY: Measurement and Analysis

110. REDUCTION OF ENVIRONMENTALLY HAZARDOUS CHEMICALS

Kennedy Space Center (KSC)

Description of the Activity:

The KSC contractor, USBI-Florida, has a Master Plan to reduce environmentally hazardous chemicals that includes UTC target objectives of 40 percent reductions by 1994.

Benefits Achieved:

USBI-Florida has implemented process changes reducing liquid waste production by more than 200 drums per year for a cost avoidance of \$20,000. In addition, projects are in work that will:

- A) Prevent the loss to the atmosphere of 1,200 pounds of fluorocarbons during annual chiller maintenance,
- B) Provide a waste water distillation system to treat alodine waste,
- C) Treat waste water from a radiographic film processor to permit recirculation, and
- D) Provide a system to separate water/oil removing hydrocarbon contamination from wash and process water, thus allowing normal water disposal and oil reclamation.

Contact for more information:

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CATEGORY: Measurement and Analysis

**111. ACOUSTICS DIVISION DATA REDUCTION AND ANALYSIS SYSTEM
(ADDRAS) DEVELOPMENT AND UTILIZATION**

Langley Research Center (LaRC)

Description of the Activity:

The current method for reduction and analysis of flight projects acoustics data at the LaRC involves digitization of the analog tapes at the center's data transcription facility. Although this capability has proven to be acceptable for many data reduction requirements, the long data records typical of the flyover data sets acquired in the acoustic code validation programs has taxed the facility beyond what it was originally developed to accomplish. The large data records and specific time correlations for ensemble averaging require large data storage capability and specialized digitizing circuitry control. A new facility has been developed for the Acoustics Division that utilizes current technology in micro-computers operating in a clustered environment controlling specially designed digitizing modules. The system includes 6 Micro Vax computers and 30 channels of high speed data acquisition. Each channel can operate at speeds of up to 250,000 samples/sec and has 16 million bytes of data storage capability. Custom triggering circuitry is included for the specialized ensemble averaging used in the flyover data acquisition. Vehicle tracking and weather data has been included in the data reduction and analysis scheme.

Benefits Achieved:

The system has now progressed to the point where it is a useful tool in quick and reliable reduction, analysis, and engineering evaluation of data acquired in the Acoustics Division. Utilization of the system has greatly reduced the drain on the Center's data transcription facility, and provided an order of magnitude reduction in time required for the data reduction and analysis process for the large data sets typical of the flight projects. The first data set that has been reduced solely by ADDRAS has been the recent test conducted at the Ames Research Center using the XV-15 ATB aircraft in hover. The system is installed in a tractor trailer configuration so that it is portable. It will be transferred to California (Crow's Landing) for the UH-60 Far-field Acoustic Test Program with pressure instrumented blades, and the XV-15 ATB follow-on program at Crow's Landing planned for the Fall of 1991. It will be available for any program where near real-time data validation is a critical element to the success of the test program.

Contact for More Information:

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CATEGORY: Measurement and Analysis

112. THE LONG DURATION EXPOSURE FACILITY (LDEF) SPACEFLIGHT ENVIRONMENTAL EFFECTS NEWSLETTER

Langley Research Center (LaRC)

Description of the Activity:

The LDEF Spaceflight Environmental Effects Newsletter, which has a circulation of approximately 1,500, is a monthly publication of the LDEF Science Office at the LaRC. The objective of the newsletter is to provide a timely dissemination of current results from the LDEF postretrieval data analysis activities to the more than 400 international investigators who are participating in the analysis, and to the managers and designers of future spacecraft who are the principal users of the LDEF data analysis results. Feature articles for the newsletter are written by the investigators who are performing the reported analysis. The compiling, editing, printing, and mailing of the newsletter is performed under contract by EER Systems in Silver Spring, Maryland.

Benefits Achieved:

The newsletter has proven to be a very effective method to quickly disseminate the results of LDEF data analysis. First, it has, by providing each investigator with a continuous overview of the findings of his peer investigators, stimulated and expanded the thinking of each. It has also improved their research outputs. Second, the newsletter is, by providing spacecraft designers and managers with the same quick and continuous overviews of the LDEF results, making a very significant contribution towards assuring the performance and reliability of future spacecraft and space missions. Third, the newsletter is allowing spacecraft designers and LDEF investigators to interact in a timely manner with each other, which helps to assure that the most critical spacecraft design problems are properly addressed in the LDEF analyses.

Contact for More Information:

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CATEGORY: Measurement and Analysis

**113. 1990 RESEARCH AND DEVELOPMENT 100 AWARD - HIGH-TEMPERATURE,
HIGH PRESSURE, LOW-LEAKAGE SLIDING SEAL FOR HYPERSONIC
ENGINES AND 2-DIMENSIONAL TURBOJET EXHAUST NOZZLES**

Lewis Research Center (LeRC)

Description of the Activity:

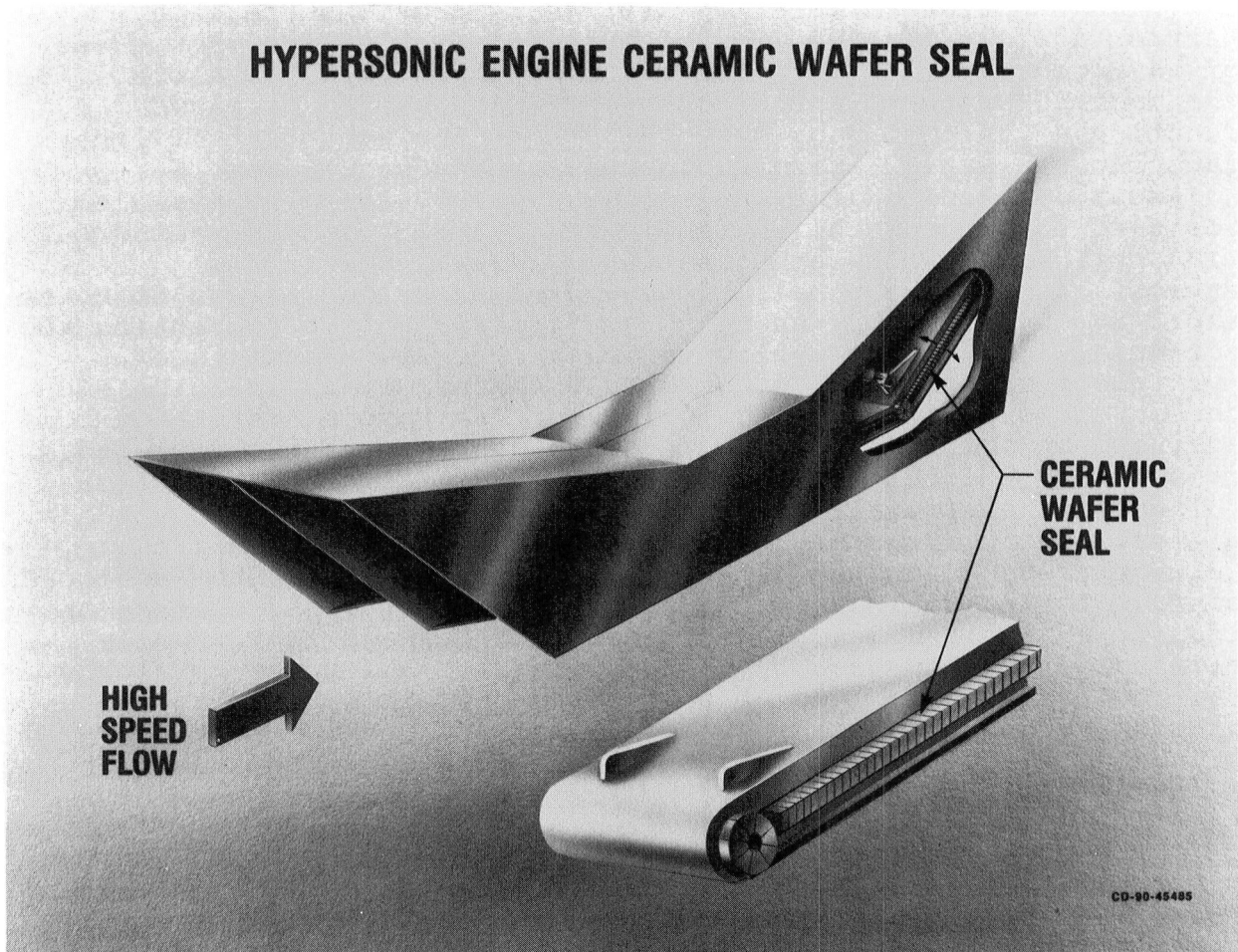
The high temperature ceramic wafer seal forms an effective barrier against leakage flow of extremely hot engine flow gases of advanced hypersonic engines such as those being developed for the Mach 25 National Aerospace Plane (NASP). The primary function of this sliding seal is to seal the many feet of linear gaps between articulating horizontal engine panels and the adjacent vertical engine walls (See Figure C-1). The seal is designed to prevent the extremely hot (>2500 F), high pressure (100 psi) engine flowpath gases from leaking behind the articulating engine panels. Preventing backside leakage of these explosive hydrogen-oxygen mixtures is paramount in preventing the potential loss of the entire vehicle. The seal consists of multiple ceramic wafers mounted in a channel along the side of the moveable horizontal engine panel. The wafers are preloaded against the splitter wall by a series of regeneratively-cooled, pressurized Inconel bellows. The seal must accommodate and seal bulges in the sidewall as large as 3/16 of an inch in only 18 in. of seal length, requiring a very compliant "serpentine" seal. Leakage tests conducted at the LeRC have proven that the seal can conform to and seal against these large distortions, meeting an industry-established leakage criterion. Leakage is virtually eliminated by good quality surface finishes and modest preloads. The seal wafers are made of engineered ceramic materials such as silicon carbide that can operate to temperatures up to 2500 F without coolant and much higher with active coolant.

Benefits Achieved:

The features and capabilities of this seal are unmatched by any other seal now in existence. This seal innovation combines a stacked-wafer flexible design with the high temperature (2500 F) capability of engineered ceramics to overcome a major hurdle of ramjet/scramjet engine design; preventing hot gas from leaking behind the movable engine panels. Sealing these critical engine components is key to successful hypersonic flight. The identifiable benefits include:

- 1) Conforming to and sealing against highly distorted (3/16" distortion in only an 18" span) engine walls

FIGURE C-1



- 2) Sealing engine pressure differentials up to 100 psc., and
- 3) Using ceramic materials operating to temperatures two times higher than superalloy steel materials.

The ceramic wafer seal is adaptable to other critical applications such as vehicle control surfaces and jet engine exhaust nozzles, etc., where high performance, high temperature, reliable seals are mandatory.

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CATEGORY: Measurement and Analysis

114. BUILDING U.S. COMPETITIVENESS THROUGH TECHNOLOGY

NASA Headquarters (Code C)

Description of the Activity:

A study to assess the economic impacts of NASA technology transfer was recently contracted. The study, entitled An Exploration of Benefits from NASA "Spinoff", estimated revenues and cost savings derived from a sample of applications reported in the NASA Spinoff publication. More than 400 applications reported between 1978 and 1986 were traced. It was found that 342 applications resulted in acknowledged contributions to sales or savings. Of these, about 75 percent, or 259 cases, permitted some quantification. The 259 applications were determined to have contributed to the sales of new or improved products in the amount of \$21.3 billion and contributed to savings of nearly \$316 million. It was also calculated that the revenues produced through the estimated sales generated Federal income tax revenues of nearly \$356 million. Additionally, 352,000 jobs were projected to have been created, or retained due to the increased revenues attributed to these spinoffs.

Benefits Achieved:

We must keep in mind that because the study concentrates on a few applications and measures only some of the quantitative benefits derived from those applications, the study may reveal only a fraction of the real value stemming from the "spinoff" of NASA technology. However, by analyzing and measuring this impact of NASA technology, we are able to see tangible results of NASA's efforts and the benefits of pursuing science and cutting edge research and development.

Contact for More Information:

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CATEGORY: Measurement and Analysis

**115. MEASURING SUCCESS OF NASA'S CENTERS FOR COMMERCIAL
DEVELOPMENT OF SPACE (CCDS) PROGRAM**

NASA Headquarters (Code C)

Description of the Activity:

NASA's 16 CCDS's are a competitively selected consortia of universities, industries, and government involved in early research and testing phases of potentially commercially viable technologies. CCDS's play a vital role in developing a technology base upon which to build new commercial space industries. The CCDS Program helps move emerging technologies from the laboratory to the market place with speed and efficiency by leveraging a broad industry base to develop product-oriented technologies and stimulate commercial cost-effective transportation and infrastructure ventures.

During 1990, participation grew from 52 to 61 universities and from 155 to 192 industry participants. Industry has proven its commitment by investing heavily in this cooperative program. For example, the average ratio of industry matching funds (measured in cash and in-kind services) to government funding for the 16 CCDS's is approximately 2.2 to 1. The ratio of just the first five CCDS's, established by NASA in 1985, has risen to 3.4 to 1. Sixty-one new technologies have been identified with commercial potential.

Other ways to measure the success of the CCDS Program include 59 patents in process, 865 publications to date in referred journals, 200 publications in work, the occurrence of 14 spinoff companies or products, and 44 technologies already being used by industry.

Benefits Achieved:

By helping industry, academia, and government work together as partners, specific commercial products or services can be targeted for research. This research will eventually lead to an increased gross national product and a stronger U.S. economy. Benefits to NASA are the direct leveraging of NASA funds at a ratio of 2 to 1, and access to breakthroughs in technology development.

Contact for More Information:

Richard Ott
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CATEGORY: Measurement and Analysis

116. DESIGN, DEVELOPMENT, AND IMPLEMENTATION OF NEW AUTOMATED SUB-SYSTEMS, SUPPORTING QUALITY CONTROL PROCEDURES AND INTRA-DIVISION TRAINING WITHIN OUR DIVISION MANAGEMENT SYSTEM

NASA Headquarters (Code HW)

Description of the Activity:

Design, development, and successful implementation of new automated sub-systems within the division on both the local area network and stand alone systems have significantly facilitated the management information capabilities and analysis of data within the division. Such systems include, but are not limited to:

- 1) A Procurement Log system which is used for tracking procurement requests from receipt to formal assignment,
- 2) A competition advocacy system which identifies salient information regarding Justifications for Other Than Full and Open Competition processed throughout the division, and their effect on managing and enhancing competition within our operating branches
- 3) An Automated Tracking System which enhances the timely receipt of executed documents from contractors, other federal agencies, etc.

Additional systems are articulated in our division management system plan, dated March 1989, as revised. Improved quality control procedures to ensure enhanced procurement documentation, including forms generation such as the NASA Form 507 inputs into FACS/AMS, supported by regular intra-division training to improve overall performance in these areas.

Benefits Achieved:

- 1) Increased accessibility of procurement information required by division personnel, management, contractors, and program offices via the LAN or local systems. Other NASA installations routinely make use of the Procurement Log and Contract/Grant Order Renewal Systems to track the progress or whereabouts of a procurement action
- 2) Code HW's automated systems have been cited in the Agency's Procurement Management Technology Program for their value and cutting edge technology
- 3) Quality control procedures have led to the cessation of redundant data entry into FACS because of the high caliber of the data entered into the system. Management willingness and confidence in the information provided is very high
- 4) Improved morale, support for, and increased use of the automated systems is a result of the intra-division training program
- 5) Significant decrease in clerical tasks required throughout the division through the automation of the same, has assisted in the retention of highly trained employees be afforded better step and grade structures
- 6) Completion of ad-hoc and standardized reporting tasks in minutes or a few hours, down from days or weeks in the past (when done manually).

Contact for More Information:

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CATEGORY: Measurement and Analysis

**117. OFFICE OF SPACE FLIGHT (OSF) PRELIMINARY METRIC TRANSITION
PLAN DEVELOPMENT**

NASA Headquarters (Code MZ)

Description of the Activity:

The Omnibus Trade and Competitiveness Act of 1988 declares that the metric system is the preferred system of measurement for U.S. trade and commerce. The Act requires that each agency convert to the metric system to the extent economically feasible by 1992. The NASA Administrator has directed the Office of Safety and Mission Quality to prepare a NASA plan for conversion. The Technical Integration and Analysis Division (Code MZ) was assigned to represent the OSF and develop the necessary plans and policies to support these activities.

The OSF Preliminary Metric Transition Plan uses the NASA program development process to aid in implementing metrication. Each OSF program currently in development or planning was characterized by its location in the development process, identified as an inch-pound, metric, or a hybrid measurement system, and evaluated as a candidate for evolution into the metric system of units.

Benefits Achieved:

This plan endeavors to achieve a smooth, evolutionary, cost responsible transition providing for a metric baseline in new programs and assuring metric compatibility in ongoing programs.

Contact for More Information:

Steve Newman
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CATEGORY: Measurement and Analysis

118. APPLICATION OF TREND ANALYSIS PROGRAMS TO RESTORE LAGOON SYSTEMS AT STENNIS SPACE CENTER (SSC).

Stennis Space Center (SSC)

Description of the Activity:

The World Services Occupational & Environmental Health Services Department issued a letter to Facility Services Division requesting support in determining the amount of sludge present in the lagoon system. Working with the Reliability Department, an evaluation of existing wastewater treatment system was completed. Discharge Monitoring Reports from 1984 to present were entered into the Reliability and Maintainability Trend Analysis Program. Using this program we identified and replaced several high failure rate components, modified maintenance schedules to prevent failures in some components and identified several possible design deficiencies.

Benefits Achieved:

The improvements described above have significantly improved the effectiveness of the wastewater treatment system and pose potential savings in excess of \$100,000.

Contact for More Information:

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601-688-2348

CATEGORY: Measurement and Analysis

119. COST REDUCTION SUGGESTION PROGRAM

Stennis Space Center (SSC)

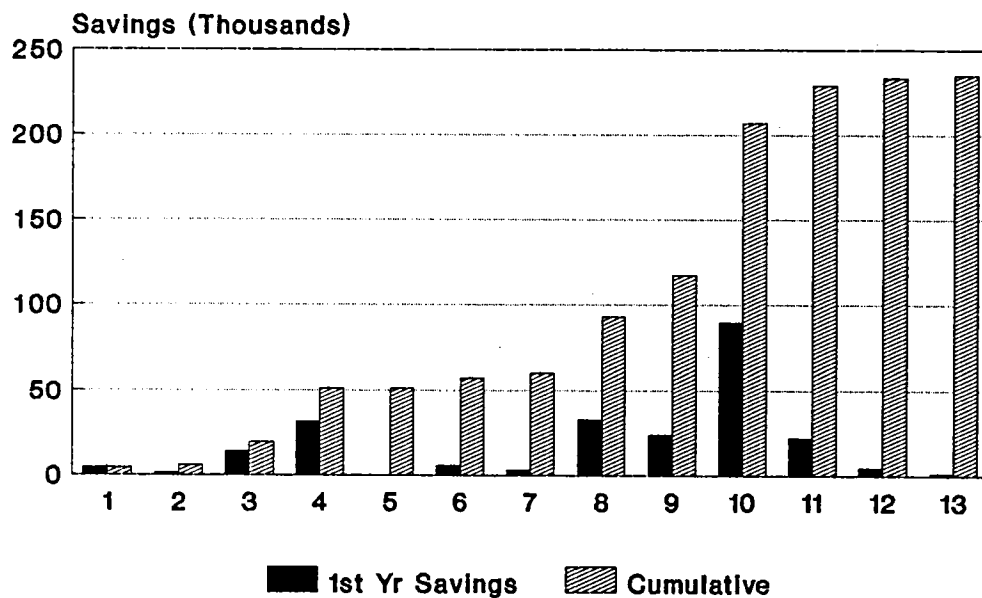
Description of the Activity:

The SSC Cost Reduction/Suggestion Program, institutionalized in April 1989, has resulted in first year savings of nearly \$200,000. Fifteen employees who submitted suggestions have shared awards totaling approximately \$10,000 (See figure D-1).

FIGURE D-1

COST SAVINGS SUGGESTIONS

April '89 - January '91



Accumulated 1st Yr. Savings - \$234,754

Benefits Achieved:

Those working hands-on with systems or equipment know best where problems exist and/or methods need improving. Encouraging their input into streamlining or cost cutting procedures and awarding a percentage of the savings to the suggestor, a "win-win" atmosphere is created. The organization clearly benefits through profitability and the employee enjoys being recognized as a valuable contributor to the organization.

Contact for More Information:

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CATEGORY: Measurement and Analysis

**120. IMPROVEMENT TO THE STENNIS SPACE CENTER STANDARDS LABORATORY
AC/DC TRANSFER CAPABILITY**

Stennis Space Center (SSC)

Description of the Activity:

A SSC Standards Laboratory technician, maintaining close coordination with the National Institute of Standards and Technology (NIST), adapted methods pioneered by NIST to equipment already on-hand at the SSC to automate precise AC/DC thermal transfers.

Benefits Achieved:

Benefits derived from this technician's initiative include:

- 1) Substantially increased speed of calibration (therefore substantial cost savings)
- 2) Greatly improved repeatability of measurements, and
- 3) Increased accuracy of measurements.

This technician also drafted a technical paper on his accomplishments which he will present at the 1991 Measurement Science Conference.

Contact for More Information:

Ken Garcia
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CATEGORY: Measurement and Analysis

121. PRODUCTIVITY MEASUREMENT BY OBJECTIVES

Stennis Space Center (SSC)

Description of the Activity:

In September 1990, personnel assigned to the SvT Electronics Repair and Calibration Laboratory developed a performance matrix. This matrix was a first attempt to measure this laboratory's total productivity. The matrix developed by this laboratory was based on the writings and model described by Glenn H. Felix and James L. Riggs. The matrix has been in operation since October 1990 and presently contains data for this short period of time.

Benefits Achieved:

Even though the matrix has not produced any monetary or manpower savings, it has been responsible for creating a higher team spirit among all the assigned technicians. Each and every technician was concerned and motivated in developing the objectives to be measured. We do expect savings to come as a result of this program.

Contact for More Information:

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601-688-2140

CATEGORY: Measurement and Analysis

122. STATISTICAL PROCESS CONTROL (SPC)

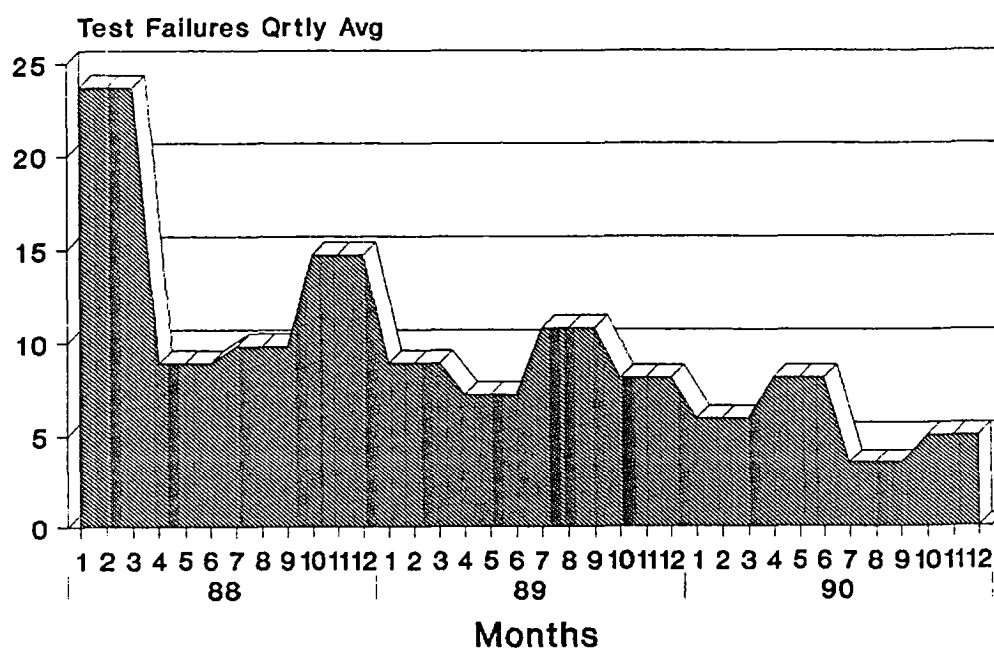
Stennis Space Center (SSC)

Description of the Activity:

SPC is being taught to each employee as a part of our "Excellence in Customer Satisfaction" training. Appropriately enough, it is included in the "Improving the Way We Work" segment of the training course. Our goal is to utilize SPC in each area to reduce variances in specifications, detect failures/defects, and identify system weaknesses. Our Quality Assurance Department, in conjunction with our Fluid Component Processing Facility, has incorporated SPC into their daily work life to some degree by monitoring failures of components and valves in the Test Cell. Since the inception of this measurement system, the failure rate has dropped from nearly 13 percent to less than 6 percent (See figure E-1).

FIGURE E-1

Johnson Controls World Services Component Processing Group



Benefits Achieved:

Graphically depicting measured progress toward specific goals works effectively to keep employees focused and motivated toward that end. Employees given ownership of a responsibility foster pride in their performance, as well as the group's performance, which results in significant benefits for the project as a whole.

Contact for More Information:

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CATEGORY: Measurement and Analysis

123. SUCCESSFUL PARTICIPATION IN THE NASA ACCELEROMETER MEASUREMENT ASSURANCE PROGRAM (AMAP).

Stennis Space Center (SSC)

Description of the Activity:

In 1990, the Jet Propulsion Laboratory (JPL) of the California Institute of Technology sponsored two NASAwide AMAPs. In January and again in June, the SSC participated by "calibrating" an unknown transfer standard and reporting the data taken to the JPL. In both of these round-robin programs, the SSC had the lowest deviation from nominal of all the participating NASA centers.

Benefits Achieved:

Successful participation in these AMAPs has boosted the confidence of the SSC Vibration Laboratory customers in the accuracy of the service provided. The success of this laboratory reflects upon the sound calibration program implemented in all of the SSC Calibration Laboratories and bolsters the pride of each calibration technician.

Contact for More Information:

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CATEGORY: Measurement and Analysis

124. USE OF STRUCTURED ANALYSIS - STRUCTURED DESIGN TO INCREASE SOFTWARE DEVELOPMENT EFFICIENCY AND REDUCE TECHNICAL RISK

Stennis Space Center (SSC)

Description of the Activity:

Structured Analysis - Structured Design (SA-SD) techniques were used exclusively during the software development activities for the Navy Deep Toed Acoustic Geophysical System (DTAGS). Computer aided design support programs (VS Designer), hosted on personal computers, were used to develop and finalize the software design. Three software engineers were involved in this design effort and its subsequent implementation.

The DTAGS hardware is quite complex, using three different types of processors and operating systems. Interface requirements among the processors, array and peripheral equipment are also quite different. Real-time code from machine language to operating system level programming was required.

Benefits Achieved:

The aerospace industry considers 12 lines per work-day the norm for real-time software experts. This number is based on the required time the software requirement specification (SRS) and planning are complete, and assumes the use of SA-SD techniques. It includes design time, coding, testing, and software and hardware integration.

Approximately 8,000 lines of real-time code were generated in about 195 work-days. This works out to be 41 lines per work-day, or about 3.4 times the norm.

Budget limitation left little time for testing the integrated DTAGS software system. Using structured analysis techniques, technical risk was dramatically reduced. Debugging time for integration of this code was almost nil, requiring only about 1 work-week.

The software performed flawlessly and was instrumental in detecting array problems which developed early in the survey runs, saving thousands of dollars and hundreds of hours which would have otherwise been wasted collecting usable data.

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QUALITY ASSURANCE

CATEGORY: Quality Assurance

125. STAND ALONE AUTOMATION OF THE AMES RESEARCH CENTER FLUID MECHANICS LABORATORY COMPRESSOR SYSTEM

Ames Research Center (ARC)

Description of the Activity:

Wind tunnels and their auxiliary equipment have traditionally been labor intensive in operation. The Fluid Mechanics Laboratory (FML) compressor was no exception. In its initial operating configuration, a full-time facility operator was assigned to monitor the controls during all compressor runs. During the past year, a number of compressor upgrades were implemented to demonstrate that the facility can operate in a full "stand alone" mode. This stand alone configuration is one phase of a longer term program to implement a fully automated preventative maintenance program using artificial intelligence principles to interrogate an operational database for prediction and correction of incipient problems.

The new control system now performs the following tasks: pre-run system checks, motor start, vibration, temperature, and other run-time checks. The software is designed to respond to user inputs by automatically reconfiguring operational parameters to conform to most efficient running condition. The control system also safely shuts down the compressor in the event of out-of-tolerance conditions. A facility operator is no longer required; the machine now operates in a "turn-key" mode requiring an operator to only start and stop it at the beginning and end of the shift.

Benefits Achieved:

By alleviating the requirement for a full time compressor operator/monitor, the FML saves approximately 600 labor hours per year. In addition, the compressor always runs at almost optimal conditions which reduces energy consumption and machine wear. FML researchers now have a reliable and accurate power source for their research investigations.

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CATEGORY: Quality Assurance

126. CERTIFICATION OF "USED" ANALOG AND DIGITAL TAPES

Goddard Space Flight Center (GSFC)

Description of the Activity:

The Magnetic Tape Certification Facility (MTCF) receives "used" analog and digital tapes and certifies them for reuse. This year, the MTCF successfully certified its 2,000,000th computer compatible tape since its inception in 1962. The certification involves a cleaning process whereby loose oxide and dirt are removed, load point and end-of-tape reflective markers are replaced, labels are removed, and canisters and reels are cleaned. The tapes are degaussed, tested end-to-end by writing and reading back test patterns, and then degaussed again. These certified tapes have provided an excellent alternative to new tapes for 28 years and have allowed millions of dollars of cost avoidance. Between 1982 and 1990, the MTCF has effected \$14,191,785 in cost avoidance.

Benefits Achieved:

During fiscal year 1990, the MTCF effected a cost avoidance of \$394,629 by certifying 90,228 computer compatible tapes and 2,091 analog tapes for reuse.

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CATEGORY: Quality Assurance

127. MISSION OPERATIONS AND COMMAND ASSURANCE

Jet Propulsion Laboratory (JPL)

Description of the Activity:

The goal of Mission Operations and Command Assurance (MO&CA) at the JPL is to help improve the operational reliability of projects while in flight. Supporting this goal is an effort to detect and correct defects in the command process as early as possible, thereby reducing the probability of radiating incorrect commands to the spacecraft. To reach this goal, MO&CA has concentrated on the following tasks:

- 1) To detect command process defects:
 - Review flight operations documentation and processes, and recommend modifications
 - Participate in operational readiness training
 - Design a comprehensive anomaly reporting and management system
 - Monitor the command process for compliance with requirements and procedures
- 2) To correct command process defects:
 - Provide command awareness training to the flight team
 - Implement an anomaly reporting system
 - Participate with flight teams in analyzing command incidents and develop corrective actions.

Benefits Achieved:

MO&CA has been a participant on four JPL flight projects: Viking (Primary Mission), Voyager, Magellan, and Galileo. On all four projects an anomaly reporting and analysis system was implemented by MO&CA and utilized in tracking, analyzing, and correcting operational problems. On the Voyager Project MO&CA provided systems support to the spacecraft team and implemented improvements in the real-time command process. On the Galileo Project MO&CA provided a pre-launch analysis of the commanding process which resulted in several operational updates. On the Magellan Project MO&CA participated in both real-time and sequence command development, providing the project with a real-time risk assessment of command uploads. MO&CA is now an integral part of these flight teams for risk assessment and command process improvement.

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CATEGORY: Quality Assurance

128. RECERTIFICATION OF PERISHABLE MATERIALS

Kennedy Space Center (KSC)

Description of the Activity:

A program was initiated by KSC contractor McDonnell Douglas Space Systems, to identify and track perishable materials in the Payload Ground Operations Contract (PGOC) stock to extend the shelf life whenever possible after the expiration date.

Benefits Achieved:

Processes have been developed to test the materials and approximately 2,500 items have been extended for use. The savings is significant because the actual cost of these items range from \$2 for a can of spray paint to \$219 for a tube of sealant. Added is the labor required to purchase, receive, label, stock new items, and excess the expired items.

Another benefit is the problem it avoids in excessing chemical materials, i.e., control of materials traceable to KSC after sale (illegal dumping, etc.).

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CATEGORY: Quality Assurance

129. TRANSPORT SYSTEMS RESEARCH VEHICLE SYSTEMS ENHANCEMENTS

Langley Research Center (LaRC)

Description of the Activity:

The ATOPS Program's Transport Systems Research Vehicle (TSRV) has been upgraded with several enhancements. A second sidearm/hand controller (SAC) system has been installed in the Research Flight Deck thus completing the modernization of the control input devices in the cockpit. The general computational capability aboard the aircraft has been completely upgraded by the addition of a second Microvax II computer, thus eliminating the older Norden PDP 11/70M computers. Similar upgrades have been made in the EASILY support lab. New software for existing experimental systems have been developed, coded, and flight validated.

Benefits Achieved:

The above replacement of aging equipment in the aircraft and support lab have provided new capability: i.e., sidestick fly-by-wire experimental base and greater flight experiment throughout. The shift to a complete Microvax system and its modern programming system has reduced the experimental software development time by a factor of 4 to 10 over previous requirements. Debugging efforts have been greatly reduced the time required for major modifications. (See figure F-1)

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FIGURE F-1



CATEGORY: Quality Assurance

130. CORTEZ III CALIBRATION FACILITY

Lewis Research Center (LeRC)

Description of the Activity:

In October of 1980, civil servants transferred responsibility for metrology services to a contractor who moved the operation off-site. The building user lease, which in 1986 was occupied by Cortez III, was at the time the best locally available. It originally was a display and service center for Bruel and Kjaer Instruments and with age and advancing technology developed many faults which included:

- 1) Frequent electrical drop-outs and brown-outs
- 2) Line transients caused by local industry
- 3) EMI/RFI caused by telephone switching, electric arc furnaces, and aircraft communications
- 4) Acoustical noise and vibration caused by aircraft and trucking
- 5) Small entries and narrow halls
- 6) Limited communication between technicians and the user, and
- 7) Environmental control was virtually non-existent.

What were our alternatives? Rehabilitation would completely disrupt service for more than one year and rehabilitation costs would be more than starting from scratch. The obvious solution was a facility designed as a calibration laboratory with functional features specified to meet all calibration requirements.

Sverdrup Technology, Inc., Cortez III Service Corporation and a developer, Flagship Properties, studied the possibilities of an Aerospace Park and presented the concept to city managers, who liked it. A package was developed and expanded, Congressional and State backing was solicited for land acquisition and improvement, educational institutions were involved and the whole plan was presented to the Center Director and other top management for approval.

Benefits Achieved:

Features designed into the building have allowed for much improved repeatability of measurement based on a stable temperature and humidity environment. The results are better quality and accuracy. Positive pressure and air locks in the standards labs not only keep those areas dust free, but allow for precision calibrations in low pressure instruments that were virtually impossible at the old facility. Electrical power conditioning and EMI/RFI screening in select electrical labs permit voltage measurements to tenths of a part per million, greatly improving the quality of all electrical calibrations. Seismic and acoustic isolation will give us the ability to calibrate micro-gravity accelerometers which currently are performed under contract with Sundstrand Data in Seattle, Washington. This capability will greatly improve communication and turnaround time and eliminate the possibility of damage in shipment to very expensive equipment.

Broader benefits include providing additional research and office space it allowed for consolidated of the supply function, improved communications at all levels, shorter, smoother pick-up and delivery routes and since we are immediately outside the West gate, users and our lab technicians have ready access to each other.

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CATEGORY: Quality Assurance

131. CREATION OF THE OFFICE OF ENVIRONMENTAL PROGRAMS (OEP)

Lewis Research Center (LeRC)

Description of the Activity:

The OEP was created to put greater emphasis on environmental health and safety concerns at the LeRC. Operation of the Center in compliance with our requirements (environmental compliance is seen as a requirement of our customer) is viewed as a necessary prerequisite for quality operation. The Office, working through the Environmental Pollution Control Board, has developed a number of new and revised policies to ensure Lewis provides a safe and healthful workplace for employees and operates so as to protect the environment. (See figure G-1)

FIGURE G-1



Working with NASA Headquarters, the Health Physics Office (HPO) completed a first phase radon survey of the highest priority buildings at LeRC. The results show no areas with radon levels above the Environmental Protection Agency's recommended maximum for indoor environments. The Hazardous Chemicals Office (HCO) initiated an inventory of all chemicals stored or in use throughout Lewis.

Benefits Achieved:

To date, over 35 buildings have been completely surveyed and over 6,000 chemicals have been identified as part of an effort to ensure safe handling of chemicals. The HCO also published a dictionary to help users understand Material Safety Data Sheets (MSDS's), developed a new NASA MSDS form for chemicals created here, developed a training packet for distribution to all new employees and worked on systems to make MSDS's available via the LIMS network.

The Industrial Hygiene Office developed systems to track and prioritize all of their work and developed strategic plans to guide their efforts in coming years. The Office also completed a survey of all ventilation hoods throughout the Center and began developing programs for controlling exposure to refractory ceramic fibers and electromagnetic radiation and programs for medical surveillance of employees who may be exposed to hazardous substances. The Environmental Compliance Office developed a spreadsheet-based system for tracking all asbestos abatement projects at the Center. The Office also installed flow meters on all LeRC wastewater outfalls to correct a deficiency which had existed for many years; developed a quality assurance program for Plum Brook Station's wastewater sampling efforts; and extensively studied and obtained permits for operation of Tank 6 in the Electric Power Lab.

The Chemical Sampling & Analysis Office completed a major study of drinking water at LeRC. The Office also performed over 800 gas analyses, over 225 fuel and oil analyses, over 200 mercury analyses and participated in a research program to use polystyrene microspheres for wind tunnel flow characteristics.

The OEP coordinated a number of training programs for LeRC personnel including Hazard Communication, radiation safety and hazardous waste management. The OEP processed over 150 safety permit requests or renewals, over 450 work requests or employee assistance requests, and reviewed over 350 chemical purchase requests. The HPO performed over 5,000 radiological analyses.

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CATEGORY: Quality Assurance

132. PURCHASE REQUEST (PR) QUARTERLY TRACKING MECHANISM

NASA Headquarters (Code DR)

Description of the Activity:

Code DR has developed an automated PR Reconciliation System. PR's are added to the system as they are processed. On a monthly basis we use the NASA Headquarter's "B" Series computer report to capture obligation data enabling us to identify deltas between commitments and obligations. It is our intent to use this data in assisting offices to identify problem areas and reconcile any differences. Our monthly data will be reviewed with the offices on a quarterly basis.

Benefits Achieved:

When fully in place, this activity will enable both the Budget Office and the submitting office to identify fallout dollars early on. These dollars could be resubmitted for commitments/obligations decreasing the base of fallout identified during a closedown. (Problem areas such as duplicate obligations will be identified early on and resolved in a timely manner.) The design and programming of this system was accomplished in fiscal year 1990, but the practical application of the system will not be fully realized until fiscal year 1991.

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CATEGORY: Quality Assurance

**133. OFFICE OF SPACE FLIGHT (OSF) PROCUREMENT DOCUMENT REVIEW
PROCESS**

NASA Headquarters (Code MR)

Description of the Activity:

In August 1990, the OSF Associate Administrator approved a new process for OSF staff review of procurement documentation and acquisition plans. This new process is a parallel review process by which the document is distributed out to all persons necessary to concur on the document at the same time. OSF staff has a minimum of five working days to review the document and make recommendations through their appropriate Directors. The staff then presents their recommendations on the document to the OSF Deputy Associate Administrator, and he either approves or assigns action items. The new processing time goal is 14 working days.

Benefits Achieved:

The new process replaces a previous process which was "serial" in nature. A document would come in to OSF for review and the first person on distribution would review it and then give it to the next person for review, and so on. The process often took two or more months to achieve an OSF recommendation. The benefits achieved by this new process can be quantified by the reduction of review time from two months to two weeks. An important, yet intrinsic benefit is the fact that issues are identified early in the process and worked at the staff level so that management has the maximum information to make the most appropriate decisions. High level management attention has been the impetus for the process to be established and to continue to be successful. Communication has also increased between the OSF technical and resources organizations; OSF and other Headquarters organizations; and OSF and the centers.

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CATEGORY: Quality Assurance

134. SRM&QA SURVEYS

NASA Headquarters (Code QR)

Description of Activity:

NASA Headquarters, Reliability, Maintainability, and Quality Assurance Division is performing assistance surveys for safety and quality assurance programs at the NASA Centers and Jet Propulsion Laboratory to assist the Centers in assuring consistent practices and highest quality products. Additionally, we are assisting the Centers in preventing reoccurrence of problems and ensuring full implementation of corrective actions consistent with NASA policies.

Benefits Achieved:

The assistance surveys provide the Centers with another perspective of the Centers SRM&QA activities associated with the individual Center program efforts as well as those programs which are multi-center programs. A product of the assistance surveys is a "Lessons Learned" report which is sent to all Centers to be used as an internal self check and as a document describing "what not to do."

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CATEGORY: Quality Assurance

**135. ELIMINATION OF PROCESS PLANS FOR OPERATORS MAINTENANCE OF
NDT EQUIPMENT AND NONDESTRUCTIVE TESTING.**

Stennis Space Center (SSC)

Description of the Activity:

Much time was expended on creating Process Plans to perform operators maintenance of nondestructive testing equipment and to perform the test method itself. The Process Plan was written each time the work was performed and required channeling the work document through an extensive review and procedure concurrence cycle.

Benefits Achieved:

By developing detailed pre-approved procedures allowing Government buy points and Quality, Safety, and Technician buy points the use of Process Plans was almost eliminated. This saves many review workhours, and allows a quicker response time to jobs.

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CATEGORY: Quality Assurance

**136. FLUID COMPONENT PROCESS FACILITY'S CAPABILITY TO REPROCESS
USED FREON INTO A PURE GRADE**

Stennis Space Center (SSC)

Description of the Activity:

The Johnson Controls World Services Inc.'s Fluid Component Process Facility uses its enhanced capability to reprocess used freon into a pure grade which can then be certified by the Technical Support Contractor. This capability is not only important from an environmental standpoint, but from an economic standpoint as well.

Benefits Achieved:

A significant materials cost savings has resulted from the improved freon recycling system. Acquisition of replacement freon was reduced by 39 barrels from 1989 to 1990. This translates to an instant cost savings of \$85,800. The rapidly increasing freon cost due to accelerating Federal taxes against ozone depleting chemicals will amplify this saving each year.

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CATEGORY: Quality Assurance

137. SUPPLIER CERTIFICATION PROGRAM

Stennis Space Center (SSC)

Description of the Activity:

The World Services, Inc.'s Shipping and Receiving Team identified the problem of improperly marked packages and packages which do not contain proper documentation for processing as a source of rework. Subsequently, a letter was sent to major suppliers notifying them of the requirement to properly mark packages being shipped to the SSC as well as timeliness of delivery - criteria necessary to remain on the approved vendor listing.

Benefits Achieved:

As a direct result of the letter of notification on compliance requirements, the number of improperly marked or unidentifiable packages declined by 41 percent the first month and 48 percent the second month. The direct benefits achieved are improved customer service (both internal and external) and a significant reduction of workhours expended researching in order to process incoming materials.

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CATEGORY: Quality Assurance

138. THE STENNIS SPACE CENTER CONVERSION TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) ANNOUNCED CHANGES IN THE ELECTRICAL UNITS AND THE INTERNATIONAL TEMPERATURE SCALE

Stennis Space Center (SSC)

Description of the Activity:

NIST had announced that effective January 1, 1990, changes were to be made to the U.S. Electrical Units (voltage, current, resistance, etc.), Mass, and the International Practical Temperature Scale (IPTS-68) in order to bring them into better international agreement. These changes were significant to many of the instruments commonly used at SSC and were, therefore, of concern to the instrument users, procurement personnel, and Quality Assurance departments. The Standards Laboratory Team was challenged with bringing the SSC into compliance with the announced changes by the target date, without adversely impacting normal operations.

The dedication to quality of the Standards Laboratory Team resulted in the calibration of more than 200 affected instruments. The team completed the calibrations in a three week period between December 18, 1989, and January 5, 1990, in addition to their normal workload.

Benefits Achieved:

A smooth transition to the new international values was insured and the confidence of SSC instrument users was safeguarded. No lost or down time was experienced at the SSC due to the efficient transition. (See figure H-1)

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FIGURE H-1



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Joyce R. Jarrett
Director
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